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**TONE RELATIONS
IN PAINTING**

ARTHUR POPE

TONE RELATIONS IN PAINTING

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PREFACE

THIS pamphlet, a large portion of which in typewritten form has been in use for several years, has been written primarily for the needs of the students in the courses in drawing and painting in Harvard University and Radcliffe College; but as an elementary statement of the theory of tone relations, containing also a certain amount of new contribution to the subject, it may be of use to others.

In the first two chapters I have tried to explain clearly and rather fully the possible classifications which may be made of the different factors that enter into visual tone, or what is in ordinary speech usually referred to simply as color. In the later chapters I have covered more briefly the principal possibilities in the application of these classifications to design and representation, in order to make as complete as possible an outline of the whole subject of tone relations.

In considerable part the pamphlet makes no claim to originality. Dr. Ross, in his epoch-making books,¹ has discussed the subject of tone relations and the use of scaled palettes at length. As these books have in some cases, however, proved rather difficult reading for the beginner, I have attempted to explain certain elementary facts which they have taken more or less for granted — especially the relation of the terminology used by Dr. Ross to other terminologies, that of Dr. Ross's classification to other possible classifications, and the bearing of the different kinds of color mixture on these.

There are some who still believe that it is unnecessary and even unwise for the painter, to say nothing of the general public, to know anything definite about the materials of the craft or the terms of the language which the painter employs. But if one compares the quality of the surface of even an average painting, dating from the XVIII century or before that time, with that of even the best paintings of the XIX or the XX century, it will be seen that

¹ Denman W. Ross: *A Theory of Pure Design; On Drawing and Painting; The Painter's Palette*. Houghton, Mifflin & Co.

the workshop traditions of the Renaissance, which were completely lost in the course of the early part of the XIX century, had something very definite to do with the beauty of performance which forms so constant a characteristic of painting down to the end of the XVIII century, but is met with so rarely in modern painting. That tradition was a matter of knowledge — knowledge of materials and procedures, acquired slowly by experimental practice in the workshop, and handed on from generation to generation of artists for centuries. This empirical knowledge, based on tradition, it is impossible to recover; but on the basis of our newly acquired understanding of tone relations it is possible to build up a practice of painting which may have many of the advantages of the older practice based on tradition. Indeed, by way of compensation, certain new and almost unexplored possibilities are suggested by a thorough understanding of the general principles governing design and representation in the terms of painting. There are some of us who believe that it is useless to expect anything significant in the way of modern art from a stupid clinging to the imitative ideals of the XIX century, on the one hand, or from vague self-expression or clumsy counterfeiting of the superficial look of primitive art, on the other, so long as there is no understanding of principles. Any genuinely significant art of the immediate future will be distinguished by the fact that it is based on both knowledge and feeling.

A. P.

CAMBRIDGE, January, 1922.

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TONE RELATIONS IN PAINTING

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CHAPTER I

DIFFERENT FACTORS IN VISUAL TONE THE TONE SOLID AND TONE SCALES

THE VISUAL IMAGE

WHEN we say that we see objects existing in space, what actually happens is that objects are projected upon the retina of the eye by rays of light travelling from the objects to the eye. This projection on the retina of the eye is a two-dimensional image (the visual image) and corresponds to a cross-section of the cone of rays of light converging on the eye. It is like the image formed on the ground glass plate of a camera. The visual image is composed of areas distinguished from each other by differences in quantity and quality of light. These areas may be placed high or low, to the right or to the left in the field of vision in relation to its center; they may be large or small in relation to other areas; they may be round, or square, or oval, or some other shape — that is, they may vary in Position, Measure, and Shape. These areas may also be light or dark; they may be red or yellow or green or blue, or some intermediate color, or they may be neutral grey; they may be strong in red or yellow or some other color, or they may be weak in color — greyish. In other words, if we use the term Value to indicate the degree of lightness or darkness, the term Color to indicate the quality due to the predominance of some one of the wave lengths which make up white light, and the term Intensity to indicate the strength of the Color as distinguished from Neutrality, we may say that these areas vary in Value, Color, and Color-Intensity. The term TONE may be used in a general way to include these three elements of VALUE, COLOR, and INTENSITY; and we may say that the Visual Image is made up of areas varying in TONE (that is, in VALUE, COLOR, and INTENSITY) and arranged in different POSITIONS, MEASURES, and SHAPES. We may define the Visual Image by defining the Position, the Measure, the Shape, and the Tone of each of its areas. We define the Tone of an area by defining its Value, its Color, and its Intensity.

Other terms are occasionally used in place of those defined above, and the same terms are frequently used in other meanings, often very vaguely. It must be borne in mind that it does not much matter what terms we use, so long as we define them clearly and use them consistently to express the different factors involved. An explanation of some of the variations in the use of terms, however, will perhaps make those used in this pamphlet more easily understood. Thus Color is sometimes used in a general sense in place of Tone. In this case one may speak of the Color of a white or black or grey area as well as of a red or yellow one. If Color is used in this general sense instead of Tone, the term Hue must be used in place of Color in the more specific sense, to indicate the distinctions as between red, yellow, green, etc. Mr. Munsell¹ has used these terms in this way, and physicists do so quite generally. In my opinion the use of the term Tone in the general sense to include the specific Value, Color, and Intensity, is less confusing. Mr. Munsell also uses the term Chroma in place of Intensity to denote the strength of Color. Another authority, on the other hand, prefers Chromisity. Saturation is sometimes used in the same sense, but it is also sometimes used in a slightly different sense, as is explained in a note in the appendix.²

We might speak of the areas which make up the Visual Image as Visual Tones, using the term as somewhat analogous to Tone in sound. They are distinguished from Auditory Tones in that they are produced by light waves instead of sound waves, and that they have extension in two dimensions in space instead of in time. We might say then that the Visual Image is made up of Visual Tones (or simply Tones) varying in Value, Color, and Intensity, and arranged in different Positions, Measures, and Shapes. We may thus speak of the areas of the Visual Image as Tones; or we may speak of the Tone of an area; or we may speak of a Tone of a given Value, Color, and Intensity in the abstract, regardless of the limitation of Measure, Shape, and Position; and we may speak of the general Tonality of a group of areas, if they approach each other closely in Value, and Color, and Intensity. These uses of the term Tone are convenient, consistent, and, I believe, easily understood.

¹ A. H. Munsell. *A Color Notation*. George H. Ellis Co. Boston.

THE TERMS OF DRAWING AND PAINTING

With pigment materials spread on a flat surface like paper or canvas, we may produce areas which, like those composing the Visual Image, have extension in two dimensions. We may make these areas light or dark; we may make them red or yellow, or some other Color; and we may make them strong in that Color, or weak, or neutral grey. We may give these areas different Positions, different Measures, and different Shapes. Thus, the Terms of Drawing and Painting are similar to the Terms of Vision — Tones produced by pigment materials, varying in Value, Color, and Intensity, and arranged in different Positions, Measures, and Shapes.

TONE SCALES

In order to think and talk definitely of Tone relations, we must make definite classifications or scales by which we may measure the different factors or elements in a Tone; so, leaving aside for the present the question of Positions, Measures, and Shapes, let us consider the possibilities in the way of the classification of Tones with regard to Value, Color, and Intensity, and the expression of the relations of these factors by graphic diagrams. All such classifications are necessarily arbitrary, and an infinite number may be made, but the following scales published by Dr. Ross are particularly useful in the actual practice of painting. These scales are of course not mathematically accurate, but must be thought of as adjusted or tempered for the convenience of the painter. To cite only one instance, the white and black of painting are not perfect white and perfect black. The best white paint or white paper absorbs a certain proportion of the rays of light falling upon the surface of the painting, and is only relatively white; similarly the best black pigment fails to absorb all of the light falling on the surface, and is only relatively black. Further inaccuracies and limitations of these scales will be discussed later on. For the present, we may confine our attention to the scales and the diagrams connected therewith, in order to obtain a clear understanding of the opportunities which they afford for definite thought and practice in connection with Tone relations.

THE SCALE OF VALUES

A convenient scale of Values in Neutral Tones may be produced, as shown in fig. 1, by starting with the limits of White (Wt) and Black (Blk), then producing a Middle Value (M), to make the same contrast with both Wt and Blk, further intermediate Values



FIG. 1.

of Light (Lt), half way between Wt and M, Dark (D), half way between M and Blk, and the additional intermediates of High Light (HLt), Low Light (LLt), High Dark (HD), and Low Dark (LD).

This scale of nine Values gives sufficiently small intervals for ordinary practice and can be easily executed with a fair degree of accuracy. In water-color it may be produced with washes of charcoal grey, or other black pigment, with the paper used for Wt.

THE SCALE OF COLORS

In a similar way we may make a scale of Colors, as shown in fig. 2, by starting with Red (R), Yellow (Y), and Blue (B), placed at equal intervals in a circular scheme. The Colors should all be produced at their highest possible Intensity. Intermediates of Orange (O) to make equal contrast with both R and Y, Green (G) half way between Y and B, and Violet (V) half way between B and R, and the further intermediates of Red Orange (RO), Orange

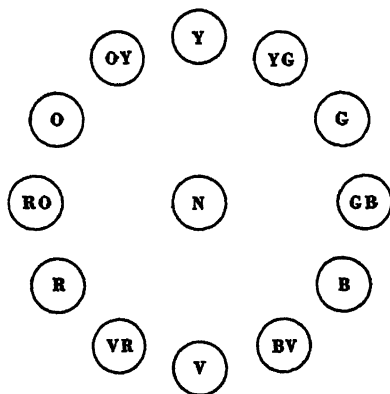


FIG. 2.

Yellow (OY), Yellow Green (YG), Green Blue (GB), Blue Violet (BV), and Violet Red (VR), may then be produced. This gives a convenient scale of twelve Colors with nearly equal intervals, and approximate pigment complementaries — not true complementaries — opposite, so that a line joining a pair of pigment complementaries crosses the center of the circle, where we may place Neutral or Grey (N).

This scale may be produced in water-color with the following comparatively permanent pigments or mixtures of these: Rose Madder or Alizarin Crimson, Vermilion, Orange Cadmium, Aureolin, Veridian, Cobalt Blue and French Ultramarine Blue.

It will be noticed that in the Color scale, produced in this way, the different Colors at their highest Intensities occur at different Values. If these are compared with the Value scale, it will be found that Y corresponds in Value approximately to HLt, that

OY and YG come at Lt, O and G at LLt, RO and GB at M, R and B at HD, VR and BV at D, and V at LD. The Value scale and the Color scale may therefore be conveniently combined as shown in fig. 3. The Colors on the left are ordinarily thought of as the Warm

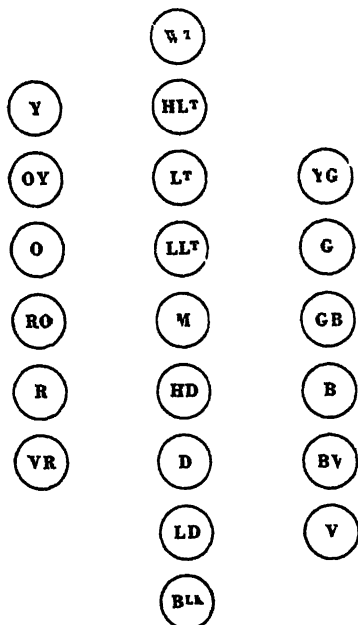


FIG. 3.

Colors; those on the right as the Cold Colors, Y and V being intermediate, neither hot nor cold.

THE SCALE OF INTENSITIES

A scale of Intensities in any Color may be made by starting with the limits of the Color at highest possible Intensity and the corresponding Neutral of the same Value, and then taking intermediates of $\frac{1}{2}$ I, $\frac{1}{4}$ I, and $\frac{3}{4}$ I, as shown for the six main Colors in fig. 4.

The degree of Intensity might be expressed in another way as degree of Neutralization, as shown in fig. 5.

The scales of Intensities may be produced with the pigments used for the scale of Colors with the addition of Charcoal Grey,

but care must be taken to add Red and Orange respectively in producing the lower Intensities of O and Y, in order to overcome the tendency for Orange to turn toward Yellow, and Yellow toward Green, when these pigments are mixed with a Black pigment.

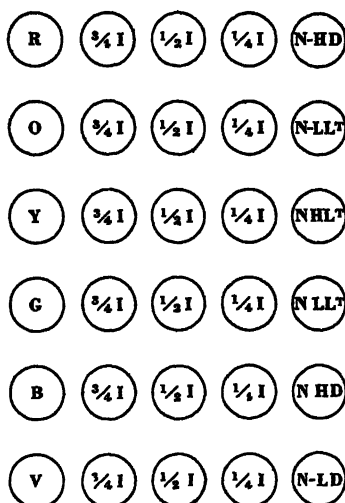


FIG. 4.



FIG. 5.

DIAGRAMS EXPRESSING RELATIONS OF VALUES, COLORS, AND INTENSITIES

Diagrams expressing graphically the relations of Values, Colors, and Intensities will be found of much assistance in achieving a clear understanding of the principles governing Tone relations both in Nature and in Painting, and especially useful in the consideration of design in Tone relations.

DIAGRAMS EXPRESSING THE VALUE AND INTENSITY
POSSIBILITIES OF EACH OF THE TWELVE COLORS

Let the vertical line, as in fig. 6, represent the scale of Neutral Greys from Wt to Blk. Red at its highest Intensity comes at the Value of HD, but it is distinguished from N-HD by its Redness and the Intensity of its Redness. If we measure the contrast made by Red at its fullest Intensity and N-HD with the contrast made by N-HD and higher and lower Values of Neutral, we shall find that the contrast of R at highest Intensity and N-HD about equals in attraction the contrast between N-HD and N between Lt

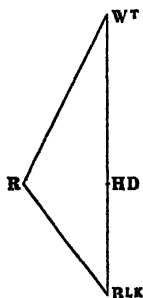


FIG. 6.

and LLt — about $2\frac{1}{2}$ steps of the Value scale (fig. 1). We may, then, in the diagram, place R at its highest Intensity at the same level as N-HD and at the distance from N-HD laterally as shown in fig. 6. This represents sufficiently accurately the Value and Intensity of R at its highest Intensity in relation to Wt and Blk and Neutrals between.

In order to raise the Value of R above HD we must introduce the element of White or of some other Neutral above HD. If we introduce the element of White, we carry the R toward Wt along the line from R to Wt. In order to lower the Value of R we must introduce the element of Blk or of some other Neutral below HD. If we introduce the element of Blk, we move R along the line R to Blk. The triangle R-Wt-Blk expresses the possibilities of Redness. We may have the quality of Red at any of the Values and Intensities within the limits of this triangle.

We may make similar diagrams for each of the twelve Colors of the Color scale, as shown in fig. 7. For the sake of simplicity in

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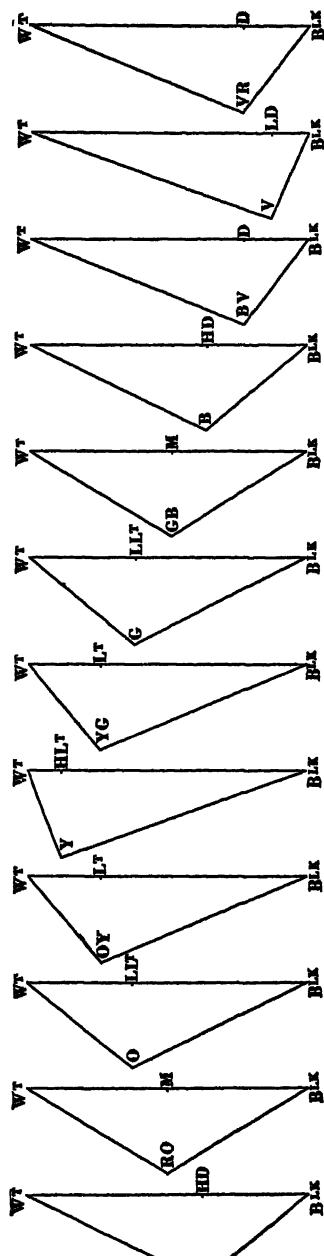


FIG. 7

the diagrams, it is arbitrarily assumed that the different Colors at their highest Intensity are of equal Intensity. The triangles are thus all made the same width.

NOTATION

On each of the vertical lines in the RO triangle shown in fig. 8 there is uniformity of Intensity. There is uniformity of Value on each of the horizontal lines.

In fig. 9 the inclined lines from RO to Wt, and from RO to Blk, represent the highest Intensities of RO which can be obtained at

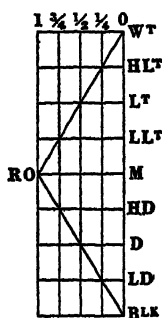


FIG. 8.

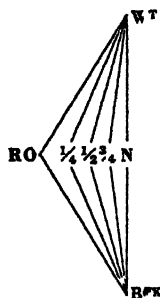


FIG. 9.

the different Value levels. The other inclined lines indicate different degrees of Neutralization.

The Neutralization lines in each of the twelve triangles are shown in fig. 10.

A Tone may be defined either in regard to its Intensity — its distance from the Neutral line; or it may be defined with regard to its degree of Neutralization from the highest Intensity of the Color obtainable at the particular Value. Thus:

RO-M- $\frac{1}{4}$ I is the same as RO-M- $\frac{3}{4}$ N (Neutralization).

RO-Lt- $\frac{1}{2}$ I is the same as RO-Lt (the highest Intensity of RO obtainable at that Value).

RO-D- $\frac{1}{4}$ I is the same as RO-D- $\frac{1}{2}$ N.

In most cases it is more convenient to define Tones by their degree of Neutralization, as in the second alternative shown in each case above. Thus: R-HD; R-HLt (the highest Intensity of R at that Value); R-M- $\frac{3}{4}$ N; O-D $\frac{1}{2}$ N; G-Lt; G-HD- $\frac{1}{2}$ N; etc.

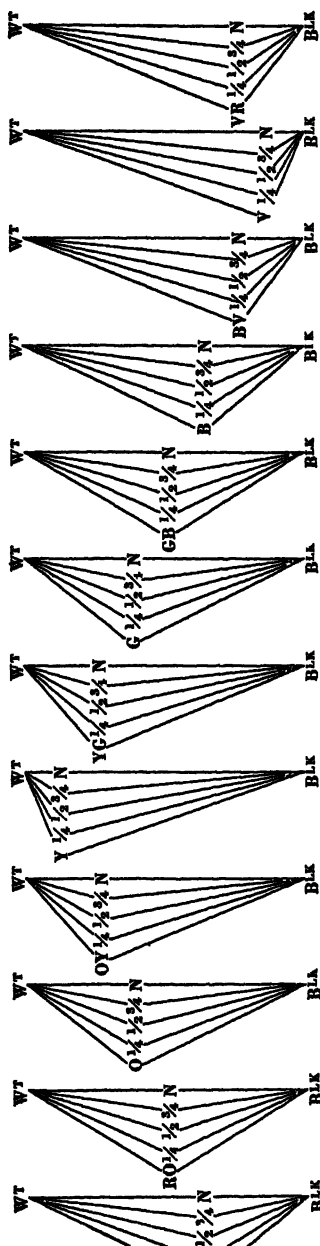


FIG. 10.

THE TONE SOLID

A three-dimensional diagram, expressing relations of Values, Colors, and Intensities, may be made by taking the triangles of the twelve Colors and placing them so that their Neutral lines coincide, forming a vertical axis from which the triangles radiate out in the order of the Color circle (fig. 2). The side elevation of this

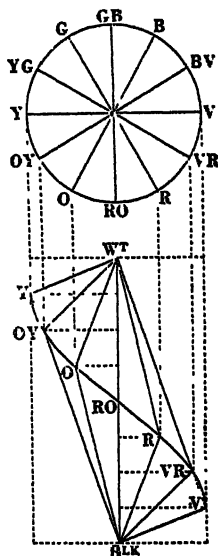


FIG. 11.

three-dimensional diagram or Tone Solid may be constructed as shown in fig. 11.

A wooden model of this Tone Solid may be easily carved out of a cylindrical piece of wood. The Colors at their fullest Intensities all touch the surface of the cylinder.

This Tone Solid, constructed on the basis of the twelve triangles, is arbitrarily symmetrical; but it will be found very helpful as a means of getting an understanding of the main facts in connection with Tone relations. The Neutral line from Wt to Blk forms the axis of the solid. As we move up or down, we get changes of Value; as we move outward, or inward, in relation to the vertical axis, we get changes of Intensity; as we move around the axis, we get changes of Color. At each horizontal level there is uniform Value;

on each radiating vertical plane, there is uniform Color; on the surface of any of a series of concentric cylinders, there is uniform Intensity.

A chart of the twelve Colors in their highest Intensities at each of the seven Values between Wt and Blk, as shown in fig. 12, gives all the main Tones on the outside surface of the Tone Solid.

This chart may be produced in water-color with the same pigments as the scales of Colors and of Intensities (figs. 2 and 4) with

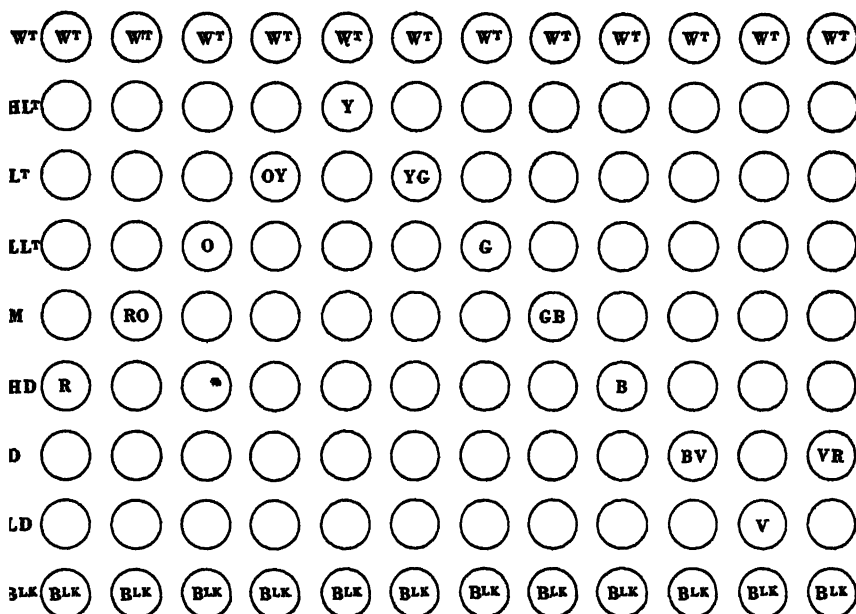


FIG. 12.

the addition of Burnt Sienna to be used in making the lower Values of O, OY, and Y. As in the scale of Intensities, care must be taken to correct the tendency in pigments for the mixture of Yellow and Orange with Black to produce Greenish Tones.

In this chart vertical rows are uniform in Color, and horizontal rows are uniform in Value. In connection with the horizontal sections of the Tone Solid, as shown in fig. 13, this chart shows clearly the possibilities of Color and Intensity at the different Value levels. At the Value of HLt, Y comes at highest Intensity, while

TONE RELATIONS

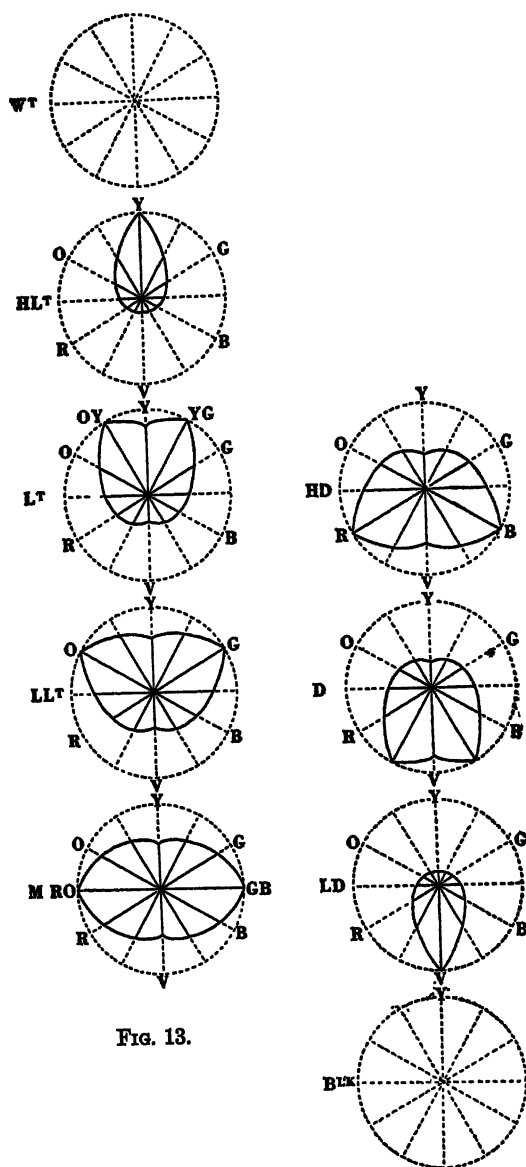


FIG. 13.

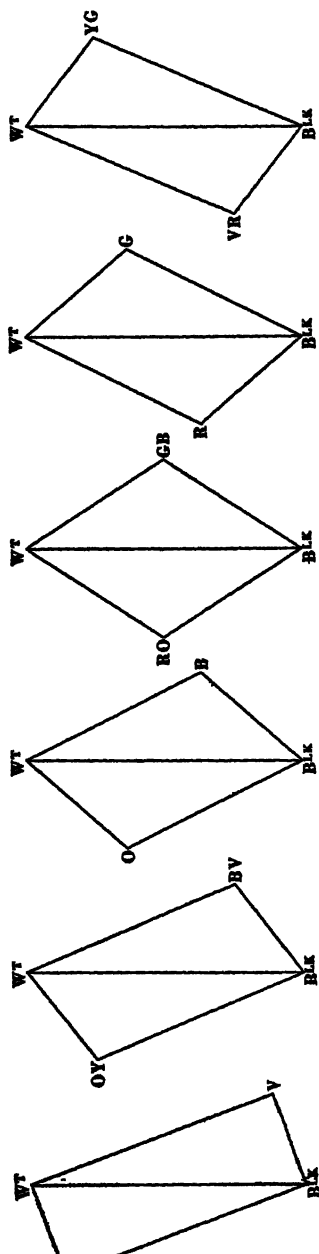


FIG. 14.

OY and YG can be obtained only at considerably less Intensity, O and G at still lower Intensity, and the Violet region, V, VR and BV only at very low Intensities. The distances between the various Tones in the diagram, fig. 13, express the relative strength of the contrasts between the corresponding Tones in the chart, fig. 12. At the Value of Lt, OY and YG reach highest Intensity, while Y moves in toward the Neutral center, and the Violets and the other Colors become a little more intense and, in the diagram, move out farther toward the outside of the circle. At M, RO and GB are at highest Intensity, while Violets and Yellows are comparatively middling in Intensity. Finally, at LD, the Yellow region shows low Intensities and limited contrasts, while Violet reaches its highest Intensity. The Yellows and Oranges in the lower Values are what are in ordinary speech vaguely called browns, red browns or olive browns; but the distinctions in Color quality, though less in degree, are exactly the same as in the higher Values. It must be borne in mind that any Color may be obtained at any Value between Wt and Blk.

Vertical sections of the Tone Solid, as in fig. 14, show the Color triangles in pairs of complementary Colors.

While it is necessary to use the three-dimensional diagram of the Tone Solid to express relations of Values, Colors, and Intensities, all at the same time, and to represent complete contrasts between Tones accurately, two-dimensional diagrams may be used to express relations of any two factors without regard to the third, and are very useful in actual practice.

THE CIRCULAR DIAGRAM OF COLORS AND INTENSITIES

By means of the circular plan of the Tone Solid, fig. 15, we may express relations of Color and Intensity without regard to Value. This is very useful, for instance, as a basis for thinking of pigment mixtures, as shown in fig. 16.

If a Red pigment is mixed with Orange, the mixture falls along the line R-O; there is slight loss of the Intensity of the two Colors. If the R is mixed with OY, the mixture falls along the line R-OY. The half-way point is between O and RO, slightly nearer the Neutral center. If the R is mixed with Y, the mixture falls along

the line R-Y, and the half-way point is on the O radius, still nearer the N center. If the R is mixed with YG, the half-way point, between the Y and OY radii, is very close to the N center. Finally, if the R is mixed with G, the half-way point is N, and the

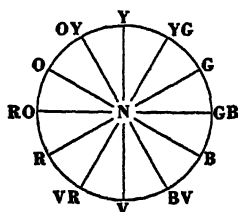


FIG. 15.

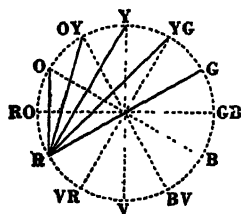


FIG. 16.

other possibilities are various Intensities of R and G, along the line R-N-G.

All pigment mixtures may be thought out on the basis of this diagram, so far as Color and Intensity possibilities are concerned. If, for example, we are painting a landscape with Burnt Sienna, Yellow Ochre, and Cobalt Blue, the limits of Color and Intensity to

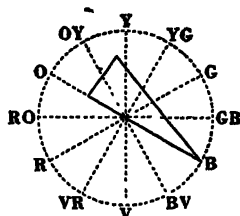


FIG. 17.

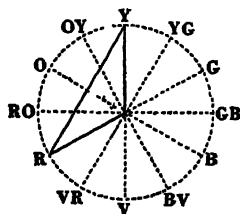


FIG. 18.

be obtained by this combination are explained in the diagram, fig. 17. If a portrait is painted in R, Y and N (Red, Yellow, and White and Black pigments), as in so many portraits by the later Renaissance masters, the diagram, fig. 18, explains the limits of Color and Intensity to be obtained by this combination. In this case the N tells in the painting as relative Blue.

THE VERTICAL DIAGRAM OF VALUES AND INTENSITIES

A vertical diagram to express relations of Value and Intensity may be made by conceiving the different Color triangles to be turned into the same plane around the Neutral axis, and arranged right and left of this axis, as shown in fig. 19. Individual Tones may be plotted at different levels to show Value, and at different distances right and left of the Neutral line to show Intensity, as in fig. 20. Lines joining these Tones in the diagram indicate the

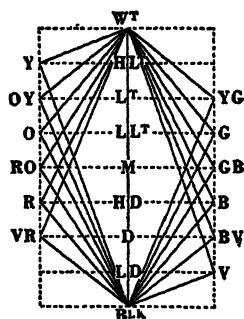


Fig. 19.

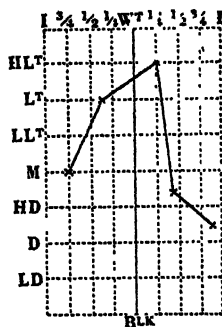


Fig. 20.

approximate contrasts between the different Tones. This diagram is useful in many ways. For example, it helps to explain the general principle governing the changes of Tone as objects model from light to dark in nature. Suppose that in relation to the limits of light and dark in Wt and Blk, three objects, R, OY, and GB in Color, have their Values and Intensities expressed in the diagram as in fig. 21. In the plane of light, their relative contrasts will be indicated by the line, R-OY-GB. As the objects model into shadow, the local Tones become darker and also less intense in proportion. In half light they are reduced, let us say, one third toward Blackness. In the diagram they may be indicated by the positions, R', OY', GB', and their contrasts by the line connecting them. If in the plane of shadow they are reduced two thirds toward Blackness, they will be indicated in the diagram by R'', OY'', GB''. Below the plane of shadow there are possibilities of deeper shadows all the way down to Black, and there are possible

transitional Tones between the different main planes. These will all fall along the diagonal lines R-Blk, OY-Blk, or GB-Blk. High reflected lights will, if the light is White, be plotted somewhere along the dotted lines up to Wt. This diagram expresses the general principle of proportional diminution of contrasts of Values and Intensities, as objects model from light into shadow. —

By a similar diagram the actual practice of most of the Mediæval and earlier Renaissance masters may also be shown. These painters were in the habit of expressing the form of individual objects with little regard for general light effect, by modelling each

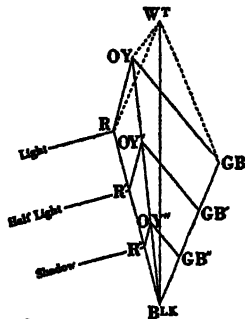


FIG. 21.

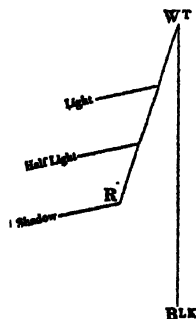


FIG. 22.

field in different Values without regard to the diminution of Intensities in nature. A Red drapery, for example, modelled according to the prescription of Cennino Cennini,¹ would be plotted as in fig. 22. The Intensity is lower in the plane of light than in the plane of shadow, just the reverse of nature's principle. This was appropriate, however, for the mode of painting employed by these painters.

THE DIAGRAM OF VALUES AND COLORS

A diagram expressing relations of Values and Colors, without regard to Intensity, consists of the various triangles of the Tone Solid projected upon the surface of the enclosing cylinder, and unfolded on a flat plane, as in fig. 23. In this figure the triangles are each represented by a vertical line, as if seen edge on. This

¹ Cennino Cennini: *The Book of the Art*, translated by Christina D. Herringham. London, 1899.

TONE RELATIONS

WT	.	.	.	.	.	.	.	.	.	.	.	.
HLT	.	.	.	.	Y	.	.	.	.	.	.	.
Lt	.	.	.	OY	.	YG	.	.	.	.	.	.
LLT	.	.	O	.	.	.	G	.	.	.	.	.
M	.	RO	.	.	.	.	.	GB	.	.	.	.
HD	R	.	.	.	.	.	.	.	B	.	.	.
D	.	.	.	.	.	.	.	.	.	BV	.	VR
LD	.	.	.	.	.	.	.	.	.	.	V	.
BLK	.	.	.	.	.	.	.	.	.	.	.	.

FIG. 23.

	N	R	RO	O	OY	Y	YG	G	GB	B	BV	V	VR
WT
HLT
Lt	$\frac{1}{2} \times N$	.....	.....	$\frac{1}{2} \times N$	.....	.....	.....	.....	.....
LLT	$\frac{2}{3} \times N$	.....	.....	.....
M
RD	$\frac{1}{2} \times N$	.....	.....	.....	.....	.....	.....
D
LD	$\frac{1}{2} \times N$	.....	.....	.....	.....	.....	.....	.....
BLK
	N	R	RO	O	OY	Y	YG	G	GB	B	BV	V	VR

FIG. 24.

diagram will be found especially useful in plotting Tones from the standpoint of design. By indicating the degree of Neutralization with figures, as in fig. 24, a complete score of a composition may be easily recorded.¹

¹ Compare Munsell: A Color Notation, pp. 55-61.

CHAPTER II

QUALIFICATIONS AND LIMITATIONS OF THE TONE SOLID. THE TRUE TONE SOLID

THE impossibility of producing perfect Tone scales in pigment materials was referred to in the last chapter. It was also stated that the scales and diagrams there set forth were made deliberately more or less inaccurate for the sake of the convenience of the painter. In this one is perhaps somewhat justified by the analogy of the tempered scale of the pianoforte which is likewise conveniently inaccurate; only our scales are rather more violently tempered.

The principal difficulty in the way of making Tone scales which shall combine convenience for the painter with scientific accuracy lies in the fact that the mixture of Colored pigments gives results frequently quite different from those obtained by the mixture of Colored light. Thus, when we mix Yellow and Blue pigments, the result is a Greenish Tone, and when we mix Yellow and Violet pigments, the result is a Neutral. On the other hand, when we mix a Yellow stream of light and a Violet stream of light, the result is a Reddish or Orange Tone, and when we mix Yellow light and Blue light, the result is Neutral instead of Green.

This is due to the fact that there are two different methods of mixing Colors. These are known as the additive and subtractive methods respectively, and they may be explained as follows. Suppose that we have two lanterns throwing streams of White light on the screen at C, in fig. 25, and suppose that we place a Yellow screen in lantern A and a Blue screen in lantern B. We may also suppose, for the sake of simplicity, that White or Neutral light is composed of a mixture of R, O, Y, G, B, and V rays.

The Yellow pigment in the screen of lantern A has the power of absorbing certain of the rays of White light, namely the B and V, and of transmitting others, the R, O, Y, and G, in which the Y dominates. The Blue pigment, on the other hand, absorbs the R, O, and Y, and transmits the G, B, and V, in which the BV dom-

inates. If we add the two streams together, we have all the rays of White light in the resulting mixture, and the mixture is Neutral, as shown in fig. 25.

On the other hand, if we shut off lantern B and put both the Y and the B screens in lantern A, part of the rays of White light are absorbed by the Y, and still more by the BV, leaving only the G transmitted to the screen, as shown in fig. 26. If we should put in also a Red screen, this would absorb the G rays, and no light of

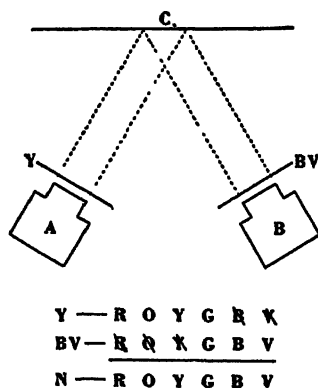


FIG. 25.

any kind would be transmitted to the screen at C. In other words the result of the mixture would be Black.

These are of course only approximate diagrams. Accurate diagrams are given by Luckiesh.¹ In fig. 27 the mixture of a possible Y and a possible BV is indicated in a diagram in which relative wave lengths (μ) are shown horizontally and relative energy vertically. There is always a difference of this sort, though sometimes not so marked, between mixture by addition and mixture by subtraction.

Pigments mix approximately on the subtractive principle. Finely divided particles of different Colors are so intermingled that light travels perhaps first through a Yellow particle and then through a Blue particle, even several times over, before being reflected back from the surface of the painting. This accounts for the fact that there is always some lowering of Value when pigments

¹ M. Luckiesh: Color and its Applications, D. Van Nostrand Co., N. Y., 1915.

are mixed together, though at times it is so slight as to make no appreciable difference. The stronger the Intensities, and the greater the Color interval, the greater will be the Value change. It is partly for this reason that it is wise to avoid too intimate a mixing of the Tones on the palette in actual painting.¹

In the "Color-top," or the Clerk-Maxwell discs, on the other hand, the mixture conforms to the additive principle. Owing to the phenomenon known as persistence of vision, the alternating

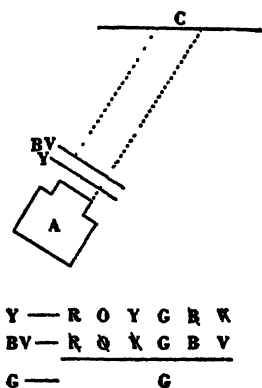
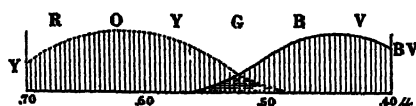


FIG. 26.



Continuous line indicates reflecting power of a possible BV pigment for all wave lengths (μ). Dotted line indicates reflecting power of a possible Y pigment for all wave lengths. Result of additive method is shown by vertical shading. Result of subtractive method is shown by horizontal shading. (Based on Luckiesh.)

FIG. 27.

streams of Y and B falling on the retina of the eye produce the same effect as in the case of the streams from the two lanterns in fig. 25.

When the Tones in a painting are juxtaposed in the "pointilist" fashion, instead of being mixed on the palette or on the brush in the ordinary way, there is a more or less close approach to mixture of streams of light on the additive principle, as in rotation, when the picture is looked at from a considerable distance.² It is seldom that a painting can be satisfactorily handled completely in this manner, but there is often some compromise between mixture by addition and mixture by subtraction.

Mr. Munsell has worked out a Color scale on the principle of rotation. This consists of five Colors taken at equal intervals, as in fig. 28. When equal areas of these five Colors at the same

¹ See Luckiesh, op. cit., pp. 297-301, and figs. 122-124.

² Lumière Color photography is based on this principle.

Value and at the same Intensity are rotated, as in the Munsell sphere, they produce Neutral. They are at exactly equal intervals for mixture on the additive principle.

In the Tone Solid shown in the last chapter the intervals between the Colors correspond approximately to pigment mixtures; approximate pigment complementaries — not true complementaries — are placed in opposing pairs.

A marked defect in the Tone Solid shown in the last chapter lies in the fact that the triangles of the twelve Colors are made all the same width, although the Colors produced at the highest Intensities obtainable with our pigment materials are not all of the same

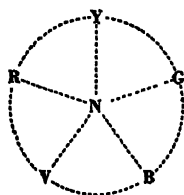


FIG. 28.

Intensity. The RO of our Color scale is much more intense than the GB, for example. In order to make a Tone Solid which would express Intensity relations accurately, it would be necessary to vary the width of the triangles according to the relative contrasts of Intensities and Values. This would produce an irregular instead of a symmetrical solid.

This difficulty is avoided in Munsell's sphere, by placing what he calls No. 5 Chromas (exactly uniform Intensities) on the equator of the sphere, all the same distance from the Neutral axis. There is an error in this, however, in that the relation between Intensity (or Chroma) contrasts and Value contrasts is not observed. Consequently in Munsell's diagrams showing the highest Intensities (Chromas) of the different Colors, these are placed at great distances from the Neutral axis, indicating, for instance, a contrast between R at its highest Intensity and N of the same Value greater than the contrast between Wt and Blk. As a matter of fact, the latter contrast exerts a much greater attraction on the eye, and the Munsell sphere and other solids and diagrams are not thoroughly accurate in this respect. The sphere, to be perfectly ac-

curate, ought to be a bobbin shaped figure of smaller diameter, approximately as indicated in fig. 29.

A fact to be noted in connection with the Munsell charts is that they are based on Tones produced with opaque pigments, and higher Intensities may be produced in transparent pigments than in opaque pigments. The highest Intensities come at different Value levels when produced with transparent pigments. On the other hand, they do not correspond exactly to the Values of the Value scale, as would be indicated by the symmetrical Tone Solid. The highest Intensity of V, for example, comes considerably

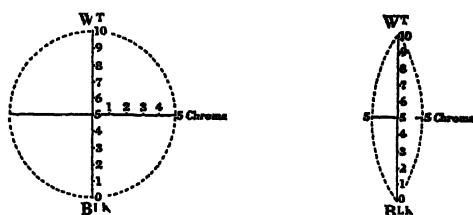


FIG. 29.

above LD, though possibly the greatest purity of V may be obtained at about that Value (see Appendix), and G is probably placed at somewhat too high a Value. This is a further inaccuracy of the symmetrical Tone Solid; nevertheless in a general way the steady descent of the high Intensity line from Y to V, through either the Warm or the Cold Colors, would be a feature of the true Tone Solid.

In spite of the limitations noted above, the symmetrical Tone Solid and the scales derived from it are most convenient devices to be used as aids to definite thinking about Tone relations. The scales are easily produced, and even memorized, with approximate accuracy, so that a painter, indeed anyone, may very quickly make use of them and the various diagrams connected with them almost unconsciously.

CHAPTER III

DESIGN IN TONE RELATIONS

IT is not my purpose in this brief pamphlet to enter into an elaborate discussion of aesthetic theory; but, having gone so far with a discussion of the different factors which enter into Visual Tone, I wish to indicate very briefly how the principles of design may be applied to the arrangement of these factors, regardless of the considerations of Positions, Measures, and Shapes. That design is fundamentally a matter of organization, and that the various manifestations of order may be classified under the general headings of Harmony, Sequence, and Balance,¹ have been clearly demonstrated by Dr. Ross in the books to which reference has already been made. It will, therefore, suffice here to define briefly what is meant by the different principles of order, or organization.

By Harmony is meant uniformity of any sort in the different parts of a composition, using the latter term in a very general sense; especially uniformity in which there is no definite feeling of change or movement, or definite feeling of opposition.

By Sequence is meant uniformity in change or movement, producing a definitely felt progression; especially where there is uniformity or uniform change in the steps or differences between the separate parts of a series. The movement or change may be gradual or alternating. In the latter case it may be called Rhythm.

By Balance is meant uniformity in opposition of any sort.

It is not necessary, at the present moment, to elaborate these definitions in regard to their application to space relations, nor to consider why, under certain circumstances, and only under these circumstances, the apprehension of order results in an aesthetic

¹ These are the terms which I prefer for the designation of the three principles of design; but it will be noted that in his later book, Dr. Ross uses the term, Repetition, in place of Harmony, while in his earlier book he had used the term, Rhythm, in place of Sequence. It is principally a difference of terminology rather than of idea.

reaction. The meaning of the terms in connection with Tone relations will become clear as their application to the different factors in Tone is considered.

HARMONY

HARMONY OF VALUE. We may, in the first place, have Harmony of Value where all the Tones in a composition are of exactly the same Value, though perhaps varying in Color and Intensity. In this case the Harmony of Value is absolute. Approximate Harmony of Value is also of importance. If all the Tones are on the whole light, within the limits of LLt to Wt for example, or on the whole dark, within the limits perhaps from D to Blk, or on the whole middling, within the limits perhaps from HD to LLt, there will be relative Harmony as opposed to the lack of it in a range of Values from Wt to Blk. This approximate Harmony of lightness or darkness is as a rule of greater importance in design than absolute Harmony of Value. It will be found an important element in a large majority of the examples of fine Tone design.

HARMONY OF COLOR. We may have absolute Harmony of Color where all the Tones of a composition are of the same Color; or we may have approximate Harmony of Color if all the Tones of a composition are on the whole Reddish, or on the whole Yellowish, or Bluish, or come within a relatively limited range of any sort, as opposed to a range of Colors covering the whole circle. Approximate Color Harmony is likewise of great importance in design.

HARMONY OF INTENSITY. Harmony of Intensity may also be absolute if all the Tones in a composition make the same contrast with Neutral; or it may be approximate if all the Tones in a composition are relatively high in Intensity, or relatively low or greyish, as compared with the whole Intensity range.

HARMONY OF VALUE AND INTENSITY — DIAGRAMS. We may have either absolute or approximate Harmony of all three factors in Tone together, or of any two factors, without Harmony of the third factor. In the case of absolute Harmony of Value, Color, and Intensity, the result is monotony, which may in some cases be important in a single field, but is not of any use in a whole composi-

tion. But approximate Harmony of Value, Color, and Intensity, where all the Tones are within a relatively small part of the whole Tone Solid, is frequently an important feature in fine Tone design. Approximate Harmony of two factors, with a relatively wider range of the third factor, is still more usual, and may be conveniently expressed in two-dimensional diagrams. Thus, given the Tones, R, OY, Wt, G, BV, and Blk, as indicated in fig. 30 A, they may be harmonized more or less definitely by pulling them all toward Blk a smaller or greater distance. A common element of relative Blackness will be introduced into all of the Tones

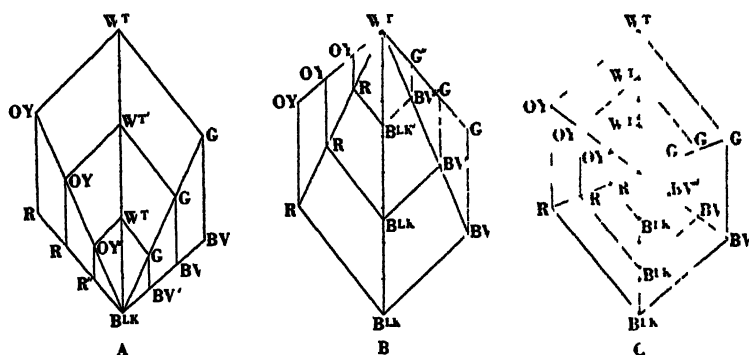


FIG. 30.

marked ', and still more strongly into all of the Tones marked ". The possibility of similar Harmonization toward Wt is shown in fig. 30 B; toward N-M in fig. 30 C.

Exercises in which the Tones are produced in a composition, first without Harmonization, and then with Harmonization in the different manners shown, will be found most helpful in illustrating the various possibilities of Value and Intensity Harmony. Examples in nature will be found in the modelling of objects toward Blackness in shadow, or their darkening as night comes on, their change toward Wt in reflected lights, or toward Neutral grey in mist or fog.

HARMONY OF COLOR AND INTENSITY. Various possibilities of Color and Intensity Harmony are illustrated in figs. 31 and 32. Given the Tones R, OY, G, and BV, as in fig. 31, they may be

harmonized by pulling them all toward N in varying degrees, as in fig. 31 A, toward Y, as in fig. 31 B, or toward VR, as in fig. 31 C. Exercises with actual Tones are helpful to illustrate more clearly the possibilities of Harmonization indicated in these diagrams also. Good examples in nature are to be found in Harmonization under the influence of different Colored lights, corresponding approximately to the changes indicated in the diagrams.

In most Venetian painting of the XVI century there is a distinctly golden Tonality. If what tells as White in a painting by Titian, for example, is compared with the Wt of White paper held in front of it, the White in the painting will be found to be in reality rather intense Orange Yellow. It tells as Wt only in relation to

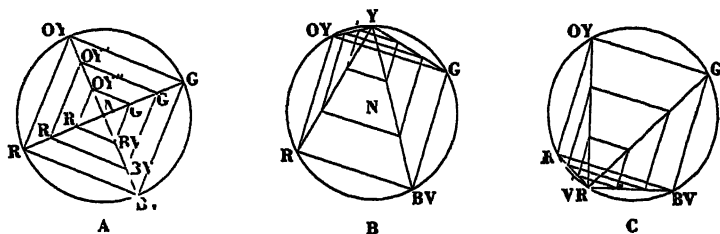


FIG. 31.

the general Tonality of the whole picture. By careful opposition of warm and cool Tones, Titian makes his Blues tell as very rich Tones; but on being compared with intense Blues, they are found to be as a matter of fact very low in intensity. The Harmony of Tonality in such a painting is perhaps best expressed in a diagram as in fig. 32 A, or perhaps better in fig. 32 B. Although there is relative expression of practically all the Colors in the Color circle, there is actually used only a very limited range of Colors and Intensities, as compared with the whole Color and Intensity circle. It is even possible to make Neutral, obtained by a mixture of White and Black pigments, tell as relatively Blue. This is done, for example, in the eyes of the Athenaeum portrait of Washington, by Stuart, in the Bo-ton Museum. Many paintings of the Renaissance, although expressing relatively warm and cool Color, contain no positively cool Tones at all. No Green or Blue pigments are employed in producing them. Some of Rembrandt's portraits are good examples.

Other possibilities in the way of limited ranges of Colors and Intensities are suggested in fig. 32 C and D. The former approximates the Harmony of Bluish Tonality found in some of Turner's water-color paintings on blue grey paper. Fig. 32 D indicates a possible Violet Tonality. There are infinite possibilities in the way of achieving Harmony of Tonality by the use of such limited ranges of Colors and Intensities, without the sacrifice of relative variety

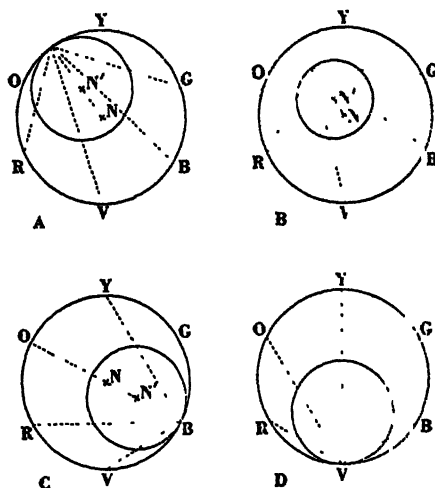


FIG. 32.

of Color. They can be applied to painting either in the mode of representation or in the mode of pure design.

HARMONY OF VALUES AND COLORS. A diagram like that shown in fig. 24 may be used, as explained on page 21, to indicate Harmony of Values and Colors without regard to the question of Intensities. The plotting of the Tones of a fine textile, for example, will frequently reveal much of the secret of the Tone Harmony which it contains, by showing a surprisingly limited range of Values. A limited range of Color, from R to Y for example, or from perhaps O to G, might also be exhibited clearly in this sort of diagram; but, as a rule, Color must be considered along with Intensity, and this diagram is not as useful as the others already described.

HARMONY OF ATTRACTION — THE PROBLEM OF QUANTITIES. In any composition the contrast of each Tone with the adjacent Tone or Tones exerts a definite attraction on the eye of greater or less power. If the attractions exerted by the Tone contrasts in all the different parts of the composition are the same, there will be uniformity of attraction over the whole surface of the composition, resulting in a generally harmonious surface. This is an important consideration in all kinds of Tone design. Fine and striking examples are to be found in Coptic textiles. Individual specimens vary in the strength of the attractions exerted by their design themes; but in any one the same force of attraction is maintained over the whole surface of the composition.

Another kind of Harmony of attraction, which, so far as I know, has not been at all adequately discussed up to the present time, is obtained by achieving a uniformity of attraction of the Tones employed in a composition, regardless of their distribution. The simplest possible illustration of this may be made by placing four or five different Tones of equal area on a Black ground Tone, allowing the Black to show on all sides of each of the other Tones. If the Tones are, let us suppose, O-Lt, YG-Lt, GB-M, B-HD, and VR-D, the VR will make the least contrast with the Blk of the ground and will exert the least attraction of all the Tones; the attraction of the B will be somewhat greater; that of the GB still greater; and that of the O and the YG greatest of all. There will be no uniformity of attraction, and practically no Harmony of any kind in the Tone arrangement. If, however, without changing in any way their Values, Colors and Intensities, the relative sizes of the different areas are changed, by cutting in with the Blk over the B, GB, YG, and O areas, the quantity of each of these other areas may be reduced until it exerts on the eye the same attraction as the larger quantity of the VR. Uniformity of attraction will then be achieved, and there will be a Harmony in the whole arrangement entirely absent before. Curiously enough this change in the quantity relations of the different areas will frequently almost make one believe that the quality of the Tones has been changed.

As it takes some experience, even in this simple exercise, to achieve perfect uniformity of attraction, the working out of problems in Harmony of attraction is excellent as a means of training

the eye in sensitiveness. The same exercise may be carried out on different ground Tones. The relative quantities of the different Tones will vary according to the contrasts made with the ground Tone. If, for example, the Tones cited above are placed on a Wt ground, the YG area will be largest, the O somewhat smaller, the GB and B still smaller, and the VR smallest of all. On an OY-Lt ground, the O and YG would be the larger areas, and the others would be much smaller, though just how much smaller must be determined by actual eye judgment.

This is the principle underlying the whole question of quantities — how much of each Tone to use in a given composition. It is of the utmost importance — one is tempted to say it is fundamental — in all Tone design.

When there is a common ground Tone, the problem is comparatively simple. Good and striking examples are to be found in many Persian textiles, and in the stained-glass windows of the XII and XIII centuries, in which the Tones are all placed against the dark of the leads and the surrounding iron and stone enframingent. The latter are also good examples of the other type of Harmony of attraction referred to above.

When the Tones are all juxtaposed, instead of isolated against a ground Tone, and especially where limited Tonalities are employed, the problem is much more complicated, but the end sought is the same. Values, Colors, and Intensities, together with quantities, have to be so adjusted that the different Tones attract the eye approximately with the same force. There is practically no difference in principle. As in the case of Harmony of Value, or Color, or Intensity, an approximation to uniform attraction will, in some cases, serve to express the idea of Harmony, and satisfy the eye almost as well as absolute uniformity. It will depend more or less on the general nature of a composition just how exact the equality must be.

The possibility of a gradation of force in the attractions of the Tones of simple patterns will be discussed under the heading of Sequence.

This will suffice to show the principal possibilities in connection with Harmony of Tone, and to suggest avenues for further experimentation and investigation. The subject can not be discussed

in detail without illustration in actual Tones, which must be more accurate than it is possible to obtain in any ordinary method of Color printing.

SEQUENCE

The subject of Tone Sequence may be dealt with in much more summary fashion than that of Tone Harmony, for it is on the whole more obvious, and examples will occur readily to everyone's mind. Skies, birds' feathers, butterflies' wings, petals of flowers, and leaves of plants, are all familiar examples of regular gradation of Value or Color or Intensity. Fields in design also are constantly organized by means of a gradation of Tone. In borders of all kinds we find familiar examples of regular alternation of Tones. It will hardly be necessary therefore to do more than, for the sake of completeness, list the possibilities with little comment.

SEQUENCE OF VALUE, COLOR, AND INTENSITY. We may have either gradual or alternate Sequence of Value, Color, or Intensity, or of any two, or of all three combined.

SEQUENCE OF ATTRACTIONS. The Tone contrasts and the Tone quantities in a composition might be so arranged that there would be a regular gradation of the attractions of the different Tones; but that this might make a definite appeal to the observer, the arrangement would have to be very simple. The importance of this form of Sequence is, I believe, somewhat problematical, though theoretically it is a possibility. An alternation of attractions is, on the other hand, constantly found in rhythmical progressions.

SEQUENCE OF VALUES AND INTENSITIES IN MODELLING FROM LIGHT INTO SHADOW. As objects in nature model from light into shadow, the Tones change in the form of a regular Sequence, as indicated in fig. 21. The relations of the Tones stay exactly the same in the different planes of modelling; but there is a proportional diminution of contrasts that produces a very definite organization in all the Tones of a subject which is governed by a simple effect of lighting. The interest of interiors, like those painted by Vermeer and de Hoogh, depends largely on the presence of this definite Sequence governing all the Tone relations. Still-life subjects also owe a large part of their interest to the organization of

the Tones following this principle. That is why many of the greatest masters from the XVII century down to our own day seem to have got more real fun out of the painting of these than of any other subjects. For the real connoisseur also, the "natures mortes," like those of Monet and Manet, little known by the general public, are perhaps the most nearly perfect performances of modern painting.

TONE SEQUENCES AS A BASIS FOR PAINTING EITHER IN PURE DESIGN OR IN REPRESENTATION. In painting more or less arbitrary Tone Sequences established on the palette are of the greatest use in achieving definite organization in the Tone relations. These may be used in such a way that the Sequences are definitely felt in the resulting composition. OY-Lt, RO-M, and VR-D would be an example of a simple Tone scheme in which there is a regular gradation of Values and Colors. Schemes of this sort, with varying Intensities, may be used in pure design. Another simple example would be: Y-HLt, R-Lt, B-LLt, Y-M, R-HD, B-D. In this case there is a repetition of the Value and Color relations in two different Value registers. YG-HLt, RO-Lt, BV-LLt, YG-M, RO-HD, BV-D, would be another similar scheme.

The principal types of Sequences which may be used in representation are discussed in Chapter IV.

BALANCE

Balance in design consists in the achievement of an equilibrium in the attraction exerted by the various Tone contrasts in a composition on either side of a vertical axis, or around a central point. In one case the Balance may be called Axial, in the other case, Central. If the Positions, Measures, and Shapes, and the Tones are arranged in an exact opposition, either on the axis or on the center, as the case may be, the Balance is Obvious. If, on the other hand, the arrangement of Tones does not correspond exactly to the arrangement of the Positions, Measures, and Shapes, but there is at the same time an equality in the total Tone attractions on either side of the axis or around the center, the Balance may be called Occult Balance. Thus in a symmetrical arrangement of Positions, Measures, and Shapes on either side of a vertical axis,

as in some of the Mediaeval or Renaissance paintings representing the Madonna and Saints, in which the Measures and Shapes of the fields on either side of the axis correspond almost exactly, a certain combination of Tones on one side may be offset by an entirely different combination on the other, so long as the total attraction is the same. In many Persian carpets there is no exact correspondence of Tones in the pattern on the two sides of the axis, but there is perfect Balance of attractions. In a similar way, in asymmetrical arrangements of Positions, Measures, and Shapes, a larger amount of a slight contrast on one side of an axis may produce the same attraction on the eye as that of a very strong contrast, but smaller in Measure, on the other side. The general principle of the lever holds for Balance of Tones in this case: the farther the Tone is from the axis or from the center, the stronger is its attraction.

The term Balance may also properly be used in connection with another form of equal opposition or antithesis, where a composition is divided into equal areas of what are on the whole light Tones as compared with others which are on the whole dark. This type of Balance is found in many of the later Renaissance landscape paintings. The composition must be fairly simple, and the lights and darks respectively well massed together, in order that the Balance may be felt. Differently Colored fields might also be balanced in this way.

Inasmuch as the relations of Colors are naturally expressed in a Color circle, with approximate complementaries opposite, it has been supposed that there must be some virtue in a "balancing" of complementary pairs of Colors, or in the adjustment of the Tones of a composition in such a way that the average of all taken together should be Neutral. In this case the Balance would certainly have to be based on the true Color circle obtained by the mixing of light, and not on the approximate Color circle. But I have never been able to feel that there was any virtue in attempted arrangements of this sort, or in the compositions cited as good examples of Color Balance, which could not be accounted for better on the hypothesis of Harmony of attraction or Harmony of Tonality of some other sort. At any rate there is no average of greyness in most of the Renaissance paintings; these almost all verge on a more or less golden Tonality. Many fine oriental and

western textiles also have distinct Tonalities of various sorts other than Neutral.

These are the principal possibilities in the way of obtaining organization in Tone relations. Each one, it must be noted, is a possibility, not a requirement; and one cannot judge of the virtue of a composition simply by noting the presence or the absence of some one or two favorite possibilities. As in all design the aesthetic reaction of a trained observer is the final test. Satisfactory design, however, depends on definite organization of some sort or other. As a general rule what is wanted is as much order and as many different kinds of it as possible, so long as a monotonous effect is avoided. Just how close monotony may be approached, and how much interest of contrast is required in any particular case, depends on individual circumstances — on the general Harmonization of a composition with its surroundings or its purpose.

CHAPTER IV

SCALED PALETTES

THE use in painting of Tone scales based on a definite classification of Values, Colors, and Intensities, has been worked out for the first time and published by Dr. Ross in the books cited above. This forms what is well-nigh a revolution in the art of painting; or perhaps it might better be called a revival, for in reality it is a return to a procedure which was well established down to the end of the XVIII century as part of the regular painting tradition which, with slight modifications, had been handed on from generation to generation for many centuries. The only difference lies in the fact that the manner of laying out the Tones on the palette, and the manner of mixing them in actual painting, was in the Renaissance a matter of workshop tradition which was almost entirely empirical, whereas the modern scales developed by Dr. Ross are primarily theoretical, based on a scientific classification of Tone relations. In addition to making possible an analysis and fairly close reproduction of many of the Tone schemes used by the masters of the Renaissance, and offering a means of recovering something of what was useful and sensible in Renaissance traditions, the latter offer also many possibilities which until a very few years ago had never been experimented with, and some, perhaps very interesting, which still remain to be tried. I must refer to Dr. Ross's books for a detailed discussion of the way in which scaled palettes may be formed and employed. I wish here merely to propose a simple classification of all possible Tone scales into a few main types, which will, I think, render the working out of new scales easier, and will at the same time explain the relation of the different scales to each other, and make the possibilities of each clearer.

All scales owe their virtue to a regular repetition of certain Color relations at different Value levels from Wt to Blk. The different Tones of a scale are mixed up separately and placed on the palette in a regular order, making a definite set of Tones within the

limits of which the painting may be produced. The range of Colors and of Intensities, as well as the width of the steps from Value to Value and from Color to Color may be varied practically to infinity, but on the whole the scales fall into two main types.

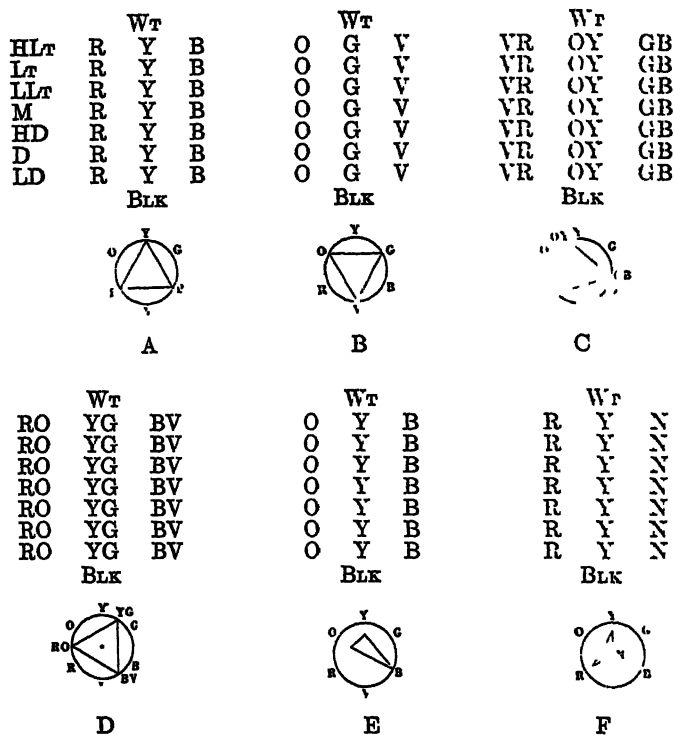


FIG. 33.

TYPE A

What may for convenience be called Type A scales include those in which there is a repetition of the same Colors in a regular succession of Values, known as Value registers. The same Colors occur in the same relation in each Value register.

TYPE A — TRIADS. In what we may call triad scales, there are three Colors in each Value register. Ordinarily it will be found most convenient to choose these Colors at approximately equal intervals in the Color circle, but any set of three may be used, as

illustrated in fig. 33. The Colors and the approximate Intensities which can be obtained by mixing in each register are shown in the circular diagrams below the different scales. The Intensity of the original Tones of the scale may be varied indefinitely according to

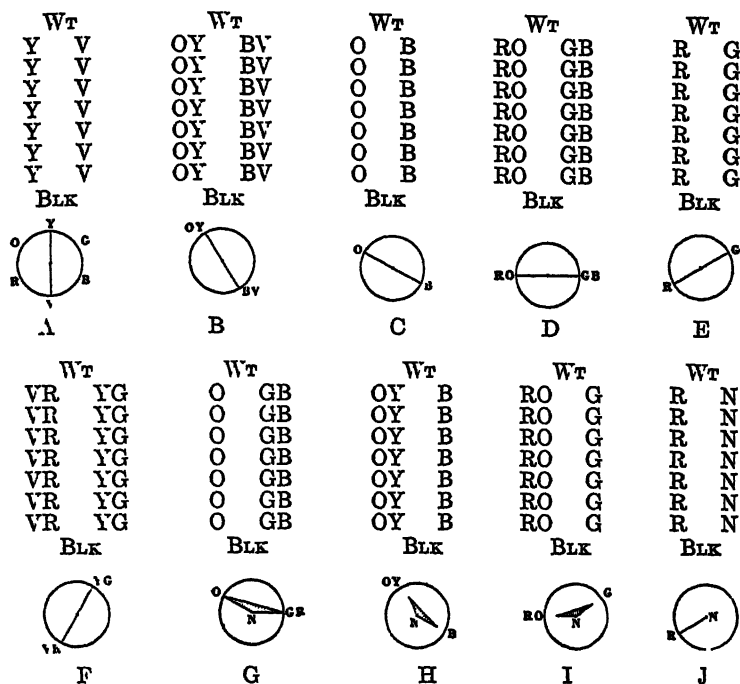


FIG. 34.

the pigments employed. In fig. 33 E, is represented the scale which would be made by limiting the pigments employed to Burnt Sienna, Yellow Ochre, Cobalt Blue and White. This is about the range of Color and Intensity to be found in much landscape painting of the XVII, XVIII, and early XIX centuries.

TYPE A — COMPLEMENTARY PAIRS. Instead of three Colors in each register, two Colors which are complementary, or nearly so, may be used (fig. 34). This makes possible only a very limited range of Color and Intensity, but it is surprising how much effect can be produced by the expression merely of different Intensities in Tones relatively warm and relatively cool. It is an abstract

method of representation in which all the possible Colors are generalized into two opposing Colors on either side of the Color circle. G and H in fig. 34 illustrate approximately Color ranges to be found in some of the landscape backgrounds of early Renaissance paintings and in some landscape paintings of the XVII century. In fig. 34 I the range of Color is similar to that found in much of the flesh painting in fresco and tempera in the Renaissance; the same scheme was probably used in the underpainting for flesh in some types of painting in the later Renaissance. Fig. 34 J rep-

Wt				
R	Y	G	B	
R	Y	G	B	
R	Y	G	B	
R	Y	G	B	
R	Y	G	B	
R	Y	G	B	
R	Y	G	B	
Blk				

FIG. 35.

resents a scale limited in Color to R and N, as in the underpainting used for flesh and to some extent for other fields in much Venetian painting of the XVI century. The final glaze of Yellow over a preparation of R and N turns the whole painting into a triad scheme based on R, Y, and N, similar to the arrangement shown in fig. 33 F.¹

NOTE. Four or even five or more Colors might be used in Type A scales, but as a general rule three Colors in a register are as many as can be handled easily, and they usually give as much variety as is needed. A scale like that in fig. 35 is, however, an interesting possibility.

In all the scales indicated above, as well as in those of Type B, which follow, variations in the Intensity of a given Color depend

¹ The Neutral Tones need not necessarily be obtained by a mixture of White and Black pigments; a low Orange pigment, like Burnt Sienna, mixed with French Ultramarine gives an approximate Black which is in some ways more satisfactory than any Black pigment.

on a mixing with the Complementary Color in the same or the adjacent registers. For certain types of painting, a scale might be made in which the relative Intensities of the main planes of light, half light, and shadow, for the modelling of each object, would be fixed on the palette. In this case there would be a separate column of Tones for each field in the painting. For a Yellow drapery, for example, as shown in fig. 36, the adjustment of Values and Intensities will follow the general scheme of the diagram in fig. 21. Any desired number of Tones from the line Y-Blk may be set out on

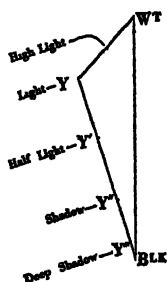


FIG. 36.

the palette — three or four would ordinarily be sufficient — for the modelling from the plane of light down to the deep shadows. High lights will come from the line Y-Wt. The Tone of each object in the plane of light is in this manner placed on the palette, and then the darker and lighter Tones required determined from this. A scheme somewhat like this was probably used by Vermeer. In his painting the fields are quite distinct, and reflections are ignored to some extent; but the Intensities in the different planes of light are very carefully adjusted to render clearly the proportional diminution of Values and Intensities as objects model down into shadow. In such painting the reflection of one object in the surface of another, or the reflection of light from the surface of one object on that of another may be rendered by a slight playing together of the scales of the separate objects. In painting of this sort there will be little of the Harmony of Tone referred to later on, which is due to the feeling of a single palette forming the basis for all the Tones in the composition; but perhaps greater feeling of existence in space and atmosphere may be achieved with this

than with other palettes. Harmony will depend on the exactness of the adjustment of Value and Intensity relations, and on the adjustment of the attractions of the Tones of the different fields.

TYPE B

What may be distinguished as Type B scales include those in which there is a regular Sequence of Color from register to register with the relations of Colors within the separate registers remain-

Wt	
Y	V
OY	BV
O	B
RO	GB
R	G
VR	YG
V	Y
Blk	

FIG. 37.

ing approximately uniform, as illustrated in fig. 37 and in others following.

TYPE B — COMPLEMENTARY PAIRS. In fig. 34 D is shown a scale in which RO and GB are repeated in all the different registers. Let us suppose that RO and GB are kept in the M register, but that in the register next above, the complementary pair is changed to that of O and B, the next above that to OY and BV, and the next to Y and V. If the same movement is continued downward, below Middle, the scale shown in fig. 37 will be formed. In this the expression in each register is limited to the range of a complementary pair, as in Type A scales; but in the scale as a whole there is a much greater variety of Color, though limited to a very definite Sequence. Furthermore still greater variety of Color may be obtained by mixing between registers on diagonals, as seen in fig. 38; but the Tones here fall also into very definite Sequences of Color. In this scale the Colors Y, OY, O, RO, R, VR, V, all come at their normal Value levels in the Tone Solid, and may be obtained at their highest Intensities.

Another scale may be made in which also we keep RO and GB in the M register, but in which we proceed in the registers above to G and R, then YG and VR, and Y and V, in order, and below,

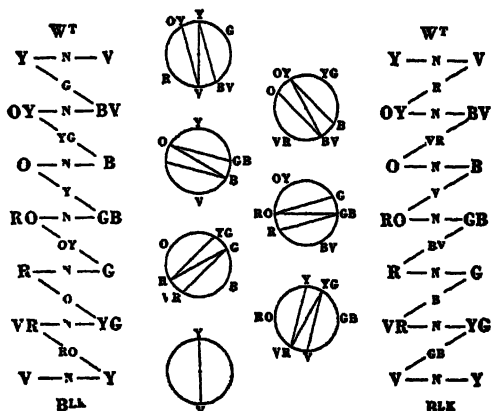


FIG. 38.

to B and O, BV and OY, and V and Y, as in fig. 39. In this scale Y, YG, G, GB, B, BV, and V come at their normal Value levels, and each one of these may be obtained at its highest Intensity.

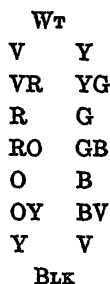


FIG. 39.

The Tones obtained by mixture in this scale are shown in fig. 40. In this, as in the preceding scale, a great variety of Color may be obtained but also all within definite Sequences.

Either one of these scales may be used separately, or they may be used together, as long as they are not mixed across so as to

destroy the feeling of the Sequences which are clearly indicated in all the vertical series in figs. 38 and 40. The arrangement of the palette in this case is shown in fig. 41.

This palette, with the possible variations in its use, is discussed at length in Dr. Ross's *The Painter's Palette*. The two scales, either together or singly, have been used for several years in the courses in painting in Harvard College; they are, I believe, especially satisfactory for the beginner, for, although they are very abstract

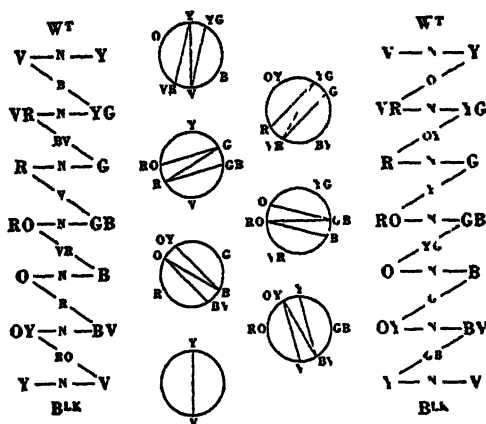


FIG. 40.

and necessitate definite thinking and clean handling, taken together they command a range of Color with which the local Tone of practically any object can be indicated. For many purposes, other perhaps more limited palettes have advantages for the practiced painter.¹

By varying the Value levels of the complementary pairs, other similar scales may be formed. If Y and V, for example, are placed in the M register, the two scales shown in fig. 42 will be formed. Keeping to seven Value registers between Wt and Blk, as in the simple Value scale described in Chapter I, twelve different scales may be formed on this principle. With variations in the number of

¹ Dr. Ross suggests the laying out of the double scale in a single series, thus:

Y YG G GB B BV V VR R RO O OY Y
V VR R RO O OY Y YG G GB B BV V

Or a selection may be made from the whole series.

Value registers and in the intervals between the Colors, different scales of this type, all perfectly orderly and perfectly usable, may be formed practically to infinity.

Wt		Wt	
Y	V	V	Y
OY	BV	VR	YG
O	B	R	G
RO	GB	RO	GB
R	G	O	B
VR	YG	OY	BV
V	Y	Y	V
Blk		Blk	

FIG. 41.

Wt		Wt	
RO	GB	GB	RO
O	B	G	R
OY	BV	YG	VR
Y	V	Y	V
YG	VR	OY	BV
G	R	O	B
GB	RO	RO	GB
Blk		Blk	

FIG. 42.

TYPE B — TRIADS. Triad arrangements of Colors may be used in Type B scales also. A few examples are given in fig. 43. These also may be varied practically endlessly. In general, however, scales of this sort are almost too cumbersome; they offer more Tones than are really needed. As triad arrangements are usually

Wt			Wt		
R	Y	B	R	Y	B
VR	OY	BG	RO	YG	BV
V	O	G	O	G	V
BV	RO	YG	OY	GB	VR
B	R	Y	Y	B	R
GB	VR	OY	YG	BV	RO
G	V	O	G	V	O
Blk			Blk		

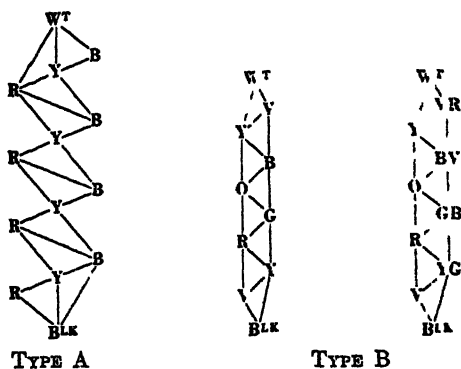
FIG. 43.

the best for ordinary purposes in Type A scales, so the complementary pair arrangements are usually the more satisfactory in Type B scales.

VARIATIONS IN THE ARRANGEMENT AND THE USE OF SCALED PALETTES. No matter how scales may be worked out, so long as they have definite order in them, they will be found to fall into one

of these main classes called here Type A and Type B respectively; and in each of these main types complementary pairs and triads will be found the most useful and the most usual arrangements. The exact intervals between Values and between Colors may, as pointed out above, be varied indefinitely.

In all the scales described in the preceding pages, the Tones within each Value register are all placed at the same Value; but a Sequence of Values might be established in each register, as



Mixtures would naturally be confined to those indicated by the connecting lines.

FIG. 44.

in fig. 44. An arrangement of this sort is especially advantageous if the scale is composed of only a few registers. It may be convenient at times to arrange the Tones on the palette in a single column, as in fig. 45. The general character of the scale is not changed by so doing.

The definite use of scales in actual painting cannot ordinarily be learned without some personal instruction; but in general it may be stated that the Tones, having once been fixed on the palette, may be mixed on the palette, or they may be mixed entirely on the canvas, or they may be juxtaposed on the canvas practically without mixing, as in well established practices of handling. It is better, however, to mix as little as possible on the palette, for intimate mixing is likely to lower the Value below that of the Tones mixed, especially if high Intensities are employed. An ex-

perienced painter will ordinarily mix his Tones to a large extent on his brush, picking up the right amount of adjacent Tones so that the stroke, without producing an intimate mixture, will give the Tone required. Refinements may be achieved by overlaying or interknitting of strokes in the wet paint without destroying the freshness of quality. One matter which few painters at the present day pay sufficient attention to is the necessity for uniform handling over the whole surface of a painting. This is a most important consideration, for unless the details in all parts of the composition

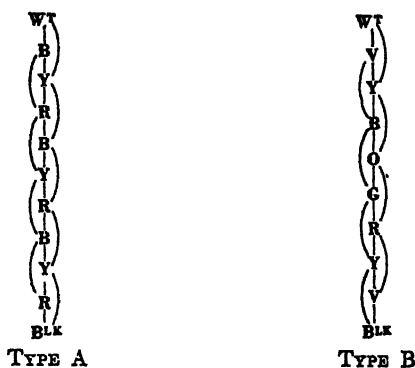


FIG. 45.

are handled with the same degree of minuteness, there will be a distinct feeling of inharmonious scale of handling in the composition as a whole. The handling may be broad, or it may be fine; it must be uniform. It should not be minute in one place and broad in another, hard edged in one part and soft edged in others. Almost all of the French and Italian paintings of the XVIII century are notable for their harmonious scale of handling. Even the skies or flat wall surfaces are painted in such a way that there is in them a feeling of the same measure of touch as in the modelling of a face or in the indication of the texture of a lace collar.

One great advantage in the use of scaled palettes is that a painter may think out the whole Tone arrangement of his work before starting to paint, and may then execute the various fields independently, working steadily from day to day, without the necessity of final retouching. Moreover, a painter may think out his work in such a way that he may easily paint from imagination,

or on the basis of drawings made from nature. A portrait may be painted on the basis of a drawing made at perhaps only one sitting, without the necessity for further sittings, in the manner followed by Holbein and other painters of the Renaissance. Notes in regard to the various local Tones, like those made by Holbein, as an aid to the memory, are all that is required. On the basis of such a definite procedure fresh and uniform quality of surface may be achieved over a whole composition. This was very much the regular procedure followed by all painters down to the close of the XVIII century, and this accounts for the difference in quality between the work of even a minor painter before the end of the XVIII century and the typical work even of the greatest men of the XIX century. Muddying of quality results necessarily from the usual practice in vogue at the present day of approximating the main masses of a composition over the whole surface, and then correcting and reworking in endless repainting over the top. No painting can be satisfactory in quality unless every stroke from the canvas up is in its right place, calculated to play its proper part in the final effect. The modern painter can ordinarily achieve fresh quality only in a quick sketch.

THE USE OF SCALED PALETTES IN THE RENAISSANCE. That the masters of the Renaissance used palettes which were carefully arranged in something of the manner of the more precisely scaled palettes discussed above, may be observed by a careful examination of their works; but on account of the overlaying and mixing of Tones in the final painting, it is usually impossible to tell exactly what all the original Tones on the palette may have been, or exactly how they were used, though at times it is probably possible to come surprisingly close to it. Usually, when artists or other persons came to write about painting, they found it too difficult to describe their technical procedures in words — partly, no doubt, because they had no definite terms for the different factors that enter into Tone — and, although frequently discussing pigment materials and their preparation in detail, they were apt to pass over the far more important part of the subject which refers to the laying out of the palette and the way in which the Tones prepared thereon were mixed and applied in actual painting, with the remark that this could only be learned by practice

under a master. Occasionally, however, writers have attempted to give more detailed information in regard to the way in which pigments were laid out on the palette, or arranged in vases, as in painting in fresco and tempera, and how these were used in practice. As at the present day we unfortunately have no masters at least in the sense in which those of the Renaissance were masters, these accounts are of the greatest interest in supplementing the information which we may obtain from the paintings themselves.

Of all these accounts that of Cennino Cennini¹ is the fullest and in many ways the most important; but the procedures which he describes are those of XIV and XV century fresco and tempera painters, and these cannot be applied directly to painting at the present day, unless it is very archaistic in style. There are also fragmentary accounts of later Renaissance procedures in certain books written in the XVII and XVIII centuries. So far, however, investigators in going through these documents have confined their attention almost exclusively to the question of pigment materials and media, or else to general aesthetic questions which the XVII and XVIII century artists did such a lot of inconclusively talking and writing about. A careful search of documents of the later Renaissance from the point of view of scaled palettes might be most instructive.² One or two passages such as I have in mind will be referred to presently.

In the painting of the Middle Ages and the earlier Renaissance a distinct scale was usually employed for each of the separate fields of the composition. Cennino describes very clearly how this was done in the XIV century. A Red drapery, for example, was painted by preparing three main Tones for the three main planes of light, half-light, and shadow: Red with a very small touch of White for the shadow, more White for the half-light, and still more White for the light. The Value and Intensity relations of this scale are shown in fig. 22. White, or White with a little Red, would be used for a few touches of high light, and Red alone, or with a little Black, for a few accents of deep shadow. The highest Intensity c

¹ Op. cit.

² Much interesting material has been gathered together in the book of *la Couleur* in the series called *L'Art Enseigné par les Maîtres*, by Henry Guerlin and Henri Laurens, Paris.

Color came in the shadow. Draperies of Blue or of other Colors were painted in a similar manner. Flesh was painted in a combination of different Values of Red, or Red Orange, and Green or Yellow Green. This procedure described by Cennino continued in use in much of the Italian painting of the XV and even of the XVI century. Sometimes, however, it was varied. Yellow, instead of White, was sometimes used to produce the lighter Tones in painting a drapery, producing in the case of the Reddish drapery a sequence of Color from R in shadow, to O or RO in half-light, to Y or OY in the light. In another drapery the sequence of Color might be from B in shadow, to GB or G in half-light, to YG or Y in the light. Sequences of Color of this sort are to be found also in Byzantine mosaics. They might be classed as Type B scales.

The painters of the XVI and XVII centuries continued to handle their separate fields almost independently, but there seems to be little written record of the procedures of this time. In Venetian painting of the XVI century, a system of opaque underpainting, with superposed transparent glazes, was used. For the flesh the underpainting was apparently frequently executed entirely in White, Black, and Red — the same limited range of Color as shown in scale J in fig. 34 — and over this opaque foundation was passed finally a glaze of Yellow, with perhaps some small preliminary touches of transparent Red. Other Tones were obtained by means of glazes over the underpainting, or by variations in the Tone of the underpainting. Simple opaque underpaintings with superposed glazes in the manner of Venetian painting were used extensively in the later Renaissance. The work of Lely illustrates this method especially clearly. Sometimes, especially for cool Colors, the underpainting was apparently simply Neutral, in mixtures of White and Black pigments, with glazes of Blue or Green above. Gradually, however, painters came to lay out their whole palettes in an arrangement of Tones which, with slight variations and a certain amount of glazing, could be used as a basis for the painting of all the different fields of a composition. This may be seen in the work of Rubens, and more especially in that of painters of the XVIII century, like Tiepolo or Boucher, who constantly used palettes in Red, Yellow, and Blue, similar to that shown in scale A in fig. 33. Some writers of the XVIII century speak of

the necessity of having a picture appear as if it were all painted with a single palette.¹

A description of what is probably a typical XVII century palette I have recently come on in a book called *Les premiers elemens de la peinture pratique*, by J. B. Corneille, "Peintre de l'Académie Royale," published in 1684. This palette is one arranged especially for painting a head, but Corneille explains that other fields are to be painted in a similar manner. A simple set of pigments is arranged along the outer edge of the palette, beginning with the lighter ones near the thumb-hole and ending with the darker ones farther away at the left end of the palette. On the main part of the palette are then mixed up two sets of Tones, one called "jours," the other "demi-teintes" and "ombres," to correspond roughly to the warmer Tones of the lights and the cooler Tones of the half-lights and shadows. As a matter of fact the arrangement results in two parallel columns with five Values in each column, the lighter Tones placed at the right nearest the thumb, grading down to darker Tones at the left. One column consists of different Values of Red, made of mixtures of White with Vermilion and Lake in varying proportions; a light Yellow, made of Yellow Ochre and White, is placed at the extreme right for the highest lights. The other column consists of a series of Neutral Tones of varying Values, grading down almost to Black; they are made of mixtures of Red, Yellow, and Blue (or Black in place of the Blue) pigments, with White used in varying amounts in the lighter ones. These two columns form the basis for the painting; but other pigments

¹ "Les couleurs doivent avoir quelque correspondance entr' elles, une perpetuelle union. les unes avec les autres, ce qu'on appelle aussi l'entente des couleurs; c'est pourquoi l'on dit qu'il faudrait qu'un Tableau fut peint d'une seule Palette." (*Traité sur la peinture* par Me. Bernard du Puy du Grez. 1700.)

"M. Jouvenet portait souvent la couleur de ses chairs pour rompre ses draperies et pour les accorder ensemble; cela revient a l'unisson et produit en partie les effets dont je viens de parler. Il est certain que si toutes ces couleurs participent les unes des autres, il est impossible qu'il n'y ait de l'union; car la participation des couleurs contribue beaucoup a l'harmonie d'un tableau, et je pense que c'est ce qui fait dire des tableaux harmonieux qu'ils semblent avoir été faits d'une seule palette." (*Essai sur les principes de la peinture*, par Jean Restout, peintre ordinaire du roi, Louis XV; publié avec des notes par A.-R. R. de l'ormigny de la Londe. Caen, 1863.)

are placed at the side to be used in connection with the other Tones. The arrangement of the main part of the palette, but turned into a vertical position, is shown in fig. 46. Supplementary Tones of varying Values and Colors were mixed up on the palette, but great emphasis is placed, in this as in other books, on the necessity of keeping the paint as fresh as possible, the subtler mixtures being made as far as possible by juxtaposing Tones on the brush and leaving them undisturbed when applied to the canvas.

All this bears testimony to an extremely careful preparation of the Tones on the palette; and all through the XVIII century and

		Wt		
		Y		
	R			
	R		N	
RO	R	Y	N	
(Vermilion)	R		N	B
R			N	
(Lake)			N	
				Blk

FIG. 46.

into the XIX century, painters continued to prepare their palettes in this painstaking way, as long as the workshop tradition lasted. The final loss of this tradition was due partly to the fact that painters, as well as the general public, which in the course of the XIX century developed into an extensive but indiscriminating patron and critic of the arts, became obsessed with the idea of imitation as the end of all art; partly to the supplanting of the older manner of training the artist as an apprentice in the workshop of a master, with the modern art school training. In France the break came rather suddenly with the suppression of the old French academy by David. It must be remembered that the old academy of the XVII and XVIII centuries was very different from the modern academy. It was more like a mediaeval guild. Formal instruction in the academy was confined to drawing and occasional lectures. The practice of painting was learned in the

workshop of the master as in the earlier Renaissance. The academy stood for tradition, at times somewhat narrow, no doubt, but nevertheless almost indispensable, unless something can be found to take its place. Some, at any rate, of the advantages of that tradition may be recovered by a rational education of the artist in a thorough understanding of the limitations and the possibilities of the terms by means of which he must express his ideas, and of the general principles which govern their use.

CHAPTER V

SUGGESTIONS FOR PAINTING IN WATER-COLOR

IT is obvious that in painting in water-color, where the Value depends on the thickness or the thinness of the wash and the way it is put on, that it is impossible to prepare a palette based on definite Value relations between the different Tones. On the other hand the use of limited ranges of Color may make it at least easier

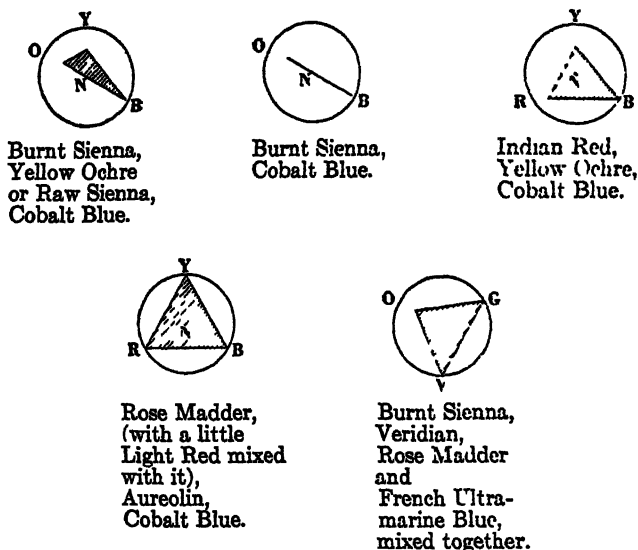
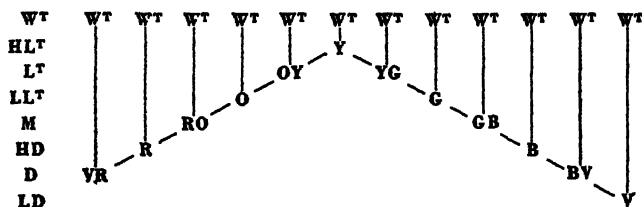


FIG. 47.

to obtain some sort of Harmony. If only a few pigments are employed, and the range of Color confined to what can be obtained with these pigments, there will result a certain amount of Harmony due to the repetition of the same simple Color relations over the surface of the composition. If it is in mind also that the fullest expression of essential relations with limited means is more important than attempted imitation of all the Tones in nature

with the unlimited resources of the modern paint box, much can be done in the way of achieving harmonious Tone in water-color painting, just as it was done in the XVIII century and in the early XIX century. The great masters of painting are conspicuous for the expression they are able to obtain from extremely limited ranges of Color and Intensity, and it is always best for the beginner to learn to get the full possibilities out of a very limited range before proceeding to less limited ranges, if indeed he finds this necessary. The work of the most brilliant modern colorists may be cited as example. Turner began by getting the full possibilities out of India Ink and a very greyish Blue pigment used to express merely essential relations of warm and cool, and even when he was forty



Rose Madder, Vermilion, Orange Cadmium, Aureolin, Veridian, Cobalt Blue, French Ultramarine Blue. These pigments are used in such a way that Colors are mixed only with adjacent Colors or with White.

FIG. 48.

years old he was using little more than an Orange brown pigment with Yellow Ochre or Raw Sienna and Blue. Monet began with the limited Color range used by Corot. The early work of Dodge Macknight may be examined with similar results. Imitators of these painters who have lacked their early discipline have almost always failed to get their harmonious Tone.

The diagrams shown in fig. 47 will illustrate some of the limited ranges of Color and Intensity which are especially satisfactory for use in water-color painting. Other similar schemes may be worked out to suit particular problems. Instead of the two-Color scheme to express relative warm and cold, shown in fig. 47 in Burnt Sienna and Cobalt Blue, Van Dyck Brown, or Bistre, or even Ivory Black might be used with Cobalt or some other Blue pigment. Such simple combinations are especially satisfactory

for architectural rendering. For ordinary purposes all the Color that is necessary can be obtained by using one of the schemes shown in fig. 47, or some similar scheme. In every case the greater the limitation possible, the better. By figuring out the possible mixtures in each case on the Color circle, one may tell almost exactly what Tones are to be obtained in each scheme.

A Harmony of high Intensities is possible in a scheme used by Dodge Macknight, which is shown in fig. 48. Pigments which give the highest Intensities of all the different Colors are laid out on the palette in the order of the Color circle. The various Tones required in a painting are obtained by mixing only between adjacent Colors and with the White of the paper, which shows in varying degrees according to the thickness of the washes. This produces a Harmony of the highest possible Intensities which can be obtained in each Color from the Value of its highest Intensity up to White. This extremely arbitrary mode of painting which requires a transposition of the Tones in nature into the strict but somewhat different order of the palette is discussed also in the next chapter and in the appendix. It is not recommended for the beginner, and for others it is adapted only for a limited range of subjects.

CHAPTER VI

VALUE RELATIONS AND INTENSITY RELATIONS IN NATURE AND IN PAINTING

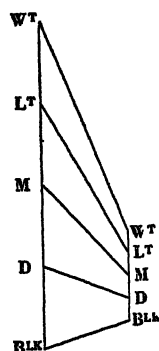
DIFFERENCES OF VALUE RANGES IN PAINTING AND IN NATURE. It is well understood that the range of Values in a painting seen in the diffused light of an ordinary room or gallery is very small compared with the range of Values in a sunlit landscape, or even in an interior where the light from a window shines directly upon the objects in a room and is reflected in their surfaces; and that in a painting only the relations of light and dark, and not the actual contrasts, can be expressed. But certain arbitrary distortions of the Value relations which may be employed, and have actually been employed in certain types of painting of the past, are not so well understood.¹ Moreover, the possible variation in Intensity range in painting as compared with that in nature has never been adequately discussed.

NORMAL EXPRESSION OF VALUE RELATIONS. Fig. 49 will do well enough to show the possible difference between the range of Values in nature and that in painting. The light of White in paint is far removed from that of White in nature. With the narrow range of Values in painting it is impossible to express the strength of contrast between different parts of the Value range in nature; and it is impossible, if the main relations are maintained, to express anything like all of the details of form which in nature are clearly brought out by the wider contrasts. On the other hand it is possible in painting to express the main relations of light and dark perfectly accurately, as may be seen in fig. 49, where the distances from Blk to D to M to Lt to Wt in painting are proportional to those in nature, though to attain this accurate rendering of nature great judgment is required on the part of the painter who must be something more than a mere matcher of Tones. Perhaps the

¹ Ruskin is the only writer, I believe, who has ever considered this problem at all. See *Modern Painters*, Vol. IV, Part V, Chapter IV, "Of Turnerian Light."

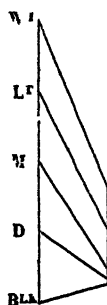
best examples of what we may call this "normal method" of rendering Value relations are to be found in the best works of Vermeer, in *Las Meniñas* and the *Villa Medici* by Velazquez, some of Corot's earlier works, and some of the paintings of Turner's middle period, like the *Pilot Boat*, which used to be in Farnley Hall.

CROWDING OF THE DARKS. Let us suppose that for some reason or other the painter is not so much interested in an accurate rendering of the proportional Value relations, but is especially interested in the strength of the contrasts in the lighter Tones, and in the strong contrast between these and the principal darker Tones.



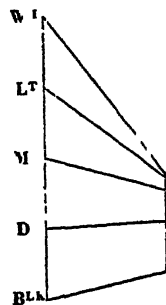
Nature Painting
Normal Rendering

FIG. 49.



Nature Painting
Crowding of the Darks

FIG. 50.



Nature Painting
Crowding of the Lights

FIG. 51.

Instead of maintaining the distances of Blk to D to M to Lt to Wt in their true relation, he may extend the upper part of the Value scale, and crowd the lower part, as in fig. 50. The painting will then be a distortion of the proportional relations, but it may possibly express his ideas better, or it may give him a general Tonality, or make possible a type of composition which is more suitable to his particular requirements. In this case the distortion is perfectly justifiable. In all cases, of course, it is finally a question of aesthetic result. Examples of compositions based on "crowding of the darks" in this fashion are to be found in the works of Caravaggio, Ribera, Rembrandt, Hobbema, Ruysdael and other Dutch landscape painters, Poussin, Claude, Wilson and Turner. In many

cases, of course, this scheme is used in connection with the rendering of an effect of concentrated light which in nature would actually produce something of the same effect; but it is notable that in many other paintings the same arrangement of Values is maintained. Almost all XVII and XVIII century landscape paintings show very dark masses in the foreground to set off the lighter Tones of the middle distance and distance, where the main interest is concentrated; and the composition regularly proceeds from dark foreground through a series of two or three lighter planes to the distance. Even in sea-pieces, like those of Van de Velde, the immediate "foreground" is regularly darkened. In landscapes the effect is often as if a huge canopy were suspended over the foreground, from under which the observer looks off into the sunlit distance. The *View of Delft* by Vermeer in the museum at the Hague is one of the few landscapes of the XVII century in which the foreground is not arbitrarily darkened and the Values are rendered throughout in their normal relations.

In figure painting "crowding of the darks" usually produces a sensational effect of large masses of extreme dark relieved by small spots of gleaming light. This effect was definitely sought for by many of the later Renaissance painters, beginning with Leonardo da Vinci. It goes along with the general sensationalism of much of this painting. In the Baroque epoch of the later XVI and XVII centuries, Caravaggio was the principal innovator in the use of concentrated light effect. Guido Reni, Guercino, and almost all of the Italian painters of the XVII century borrowed the scheme; it was also imitated by many of the Northern painters who studied in Italy, as shown in some of the early works of Rubens and Van Dyck; and the Spanish-Neapolitan painter, Ribera, made it a principal means for the expression of his sensational conceptions.

CROWDING OF THE LIGHTS. Turner, in some of his later work, and other painters, like Monet for instance, following his example, have tried to achieve more and more of an impression of illumination in the composition as a whole by exactly reversing this process and "crowding the lights," instead of the darks, as shown in fig. 51. In this case, the canvas tends on the whole to become a glare of light, with very slight contrasts and little indication of detail in the lighter portions, and with perhaps a few small accents

of darker Tones in the foreground. This has often been supposed to come closer to nature, but it is in reality just as arbitrary as the crowding of the darks.

CROWDING OF BOTH LIGHTS AND DARKS. Rembrandt, in some of his works, crowds both ends of the Value range, as shown in fig. 52, sliding over the intermediate Tones rapidly, and thereby increasing the effect of the contrast between light and dark. In

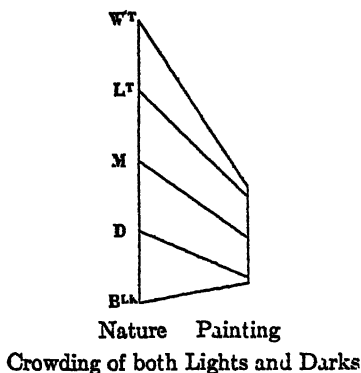


FIG. 52.

the work of many figure and portrait painters a slight pulling up of the darks and half-lights in the planes turned toward the light is used to increase the effect of broad illumination in such passages. Examples are to be found in the portraits of Reynolds and of other English painters.

I do not mean to suggest that painters have worked directly from nature, consciously distorting Value relations in this way; but the various hypotheses indicated in these diagrams will serve to explain the general conceptions which on different occasions governed the painters' interpretations of the effect of light and dark.

NORMAL INTENSITY RANGE. In a similar way it will be seen from fig. 53 that the possible Intensity range in nature is much greater than that in painting, but that the relations of Intensities to Values in nature may be accurately expressed in their true proportion in painting. To represent the possibilities as clearly as

possible, let us suppose that we have one Tone in nature, *a* in fig. 54 A. Within the narrower limits of Values and Intensities in painting, *b* in fig. 54 B represents its Intensity in relation to the Value range in true proportion. This, shown also in fig. 54 B', we may call the "normal rendering of Intensity relations." The *View of Delft* by Vermeer, many paintings by Corot, many by Constable, many by Turner from his middle period, a painting like

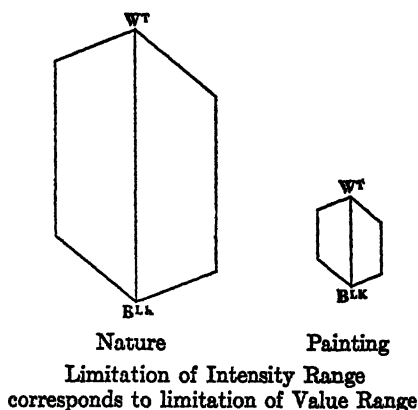


FIG. 53.

the *Westminster Bridge* by Whistler, as well as many early Monets, may be cited as examples of this normal method of painting.

SUPPRESSED INTENSITY RANGE. On the other hand, many painters, particularly landscape painters of the XVII and XVIII centuries, perhaps partly on account of custom, or because of limitations of pigment materials, or for the sake of greater Tone Harmony, have arbitrarily expressed themselves in what we may call a "suppressed" Intensity range. In this case *a* of fig. 54 A is represented by *c* in C. This, shown also in fig. 54 C', produces an effect of very subdued Color. Relative degrees of Intensity are of course represented within this narrower range. In addition to painters of the XVII and XVIII centuries, who for the most part used warm golden Tonalities, Whistler in the XIX century very frequently suppressed the range of Intensities in a perfectly arbitrary fashion for the sake of greater Tone Harmony.

EXAGGERATED INTENSITY RANGE. Still other painters in recent times have attempted to express more of the positive Intensity of Color in nature, and more of the total brilliancy of out-of-door contrasts, by exaggerating the Intensity range in relation to the

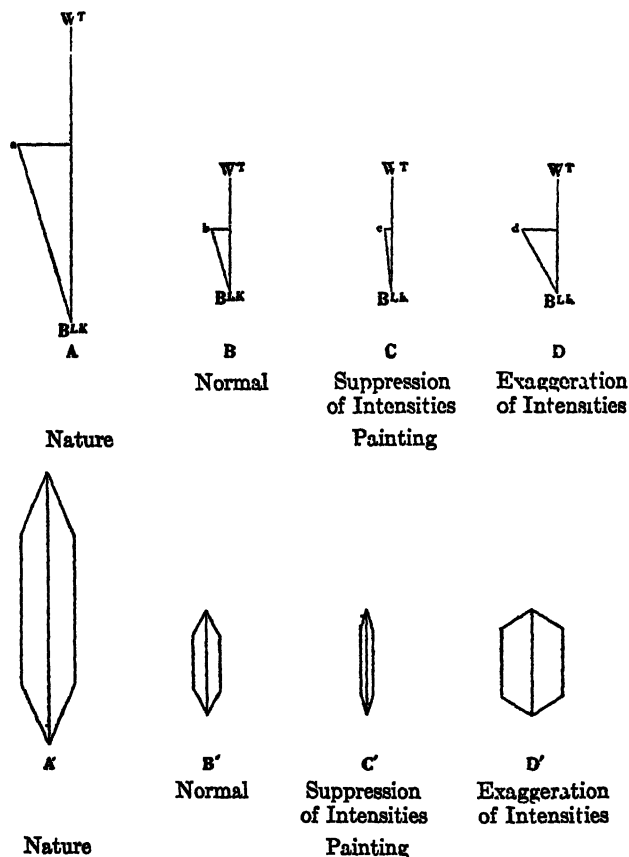


FIG. 54.

Value range. In this case *a* of fig. 54 A is rendered perhaps by *d* in D. The same idea is shown also in fig. 54 D'. By means somewhat on this order, painters like Monet, Renoir, Dodge Macknight, and perhaps Turner in some of his later work, though he was more often merely handling especially brilliant effects in nature in a

nearly normal manner, have been able in a measure to compensate for the loss of Value contrasts in painting, by substituting greater proportional Color and Intensity contrasts, and in this arbitrary manner to express something of the emotional reaction which they have felt in the presence of nature. As a matter of fact most of these painters have tended to transpose the Tones of nature into a Harmony of highest possible Intensities (see also Appendix), as indicated in the diagram in fig. 48. They have laid out on their palettes only pigments of high Intensity from Red around to Violet, and have mixed these only with adjacent Colors or with White. This is, I believe, the real explanation of the special qualities of the palette employed by Monet, instead of the pseudo-scientific theory of the breaking up of light into all the Colors of the spectrum, usually offered. The transposition from nature is perfectly arbitrary. When the average untrained observer objects to the Tones in these paintings as untruthful, he is usually told that this is the way the painter sees them in nature. It is nothing of the sort. The painter makes an arbitrary transposition into a scheme of his own for the sake of expressing what he considers most important in the organization of the Tones in nature, and to express more convincingly his emotional reaction. Everyone has in a way to get used to the conventions employed before he can understand what the painter is driving at. I have never known anyone to understand a picture by Dodge Macknight, for instance, the first time that he has seen any of this painter's work.

APPENDIX

I

THE FACTORS OF PURITY AND ENERGY OF VIBRATION

ORDINARILY in discussing Tone relations the only factors considered are Value, Color, and Color Intensity, though, as I have pointed out, these three factors are given various names in the terminology of different authorities. It is possible to define any Tone accurately by giving its Color, Value, and Intensity. There are, however, two other factors which it is of some importance to consider in order to gain a complete understanding of the subject of Tone relations. I propose to call these Purity and Energy of Vibration, respectively. As shown in figs. 55 and 57, the lines which represent these elements in the vertical diagram of Values and Intensities, and in the Tone Solid, run obliquely to the Value and Intensity lines.

Let us suppose that we have a pigment which, when spread over a flat surface, gives us the Color of Orange, that this pigment is, for the sake of simplification of argument, of such a quality that it reflects all of the Orange rays, out of the rays of White light which fall upon the painted surface, but that it absorbs all the other rays of White light. We have then Orange of absolute Purity and of highest possible Energy, in relation to the Energy of the light falling on the surface. If the whole of White light is represented by the dotted line in fig. 56, which is a diagram showing relative rapidity and energy of vibration similar to that used by physicists, the Orange will be represented by the uppermost dark line. In fig. 55, in which the White and the Black are assumed to be perfect White and perfect Black, the Orange will come, let us suppose, at O. If the strength of the White is reduced until White is lowered to Wt', the Orange will be reduced to O'. As shown in the middle dark line in fig. 56, it will still be absolutely pure, but it will not be as strong in vibration. If the strength of the White light is now

reduced until White comes at Wt'' , Orange will fall to O'' in fig. 55, or to the lowest dark line in fig. 56. In other words there is absolute Purity in all the Tones along the line O-Blk. It is possible that these Tones might be achieved by changes in the quality of the pigment without reducing the strength of the White light fall-

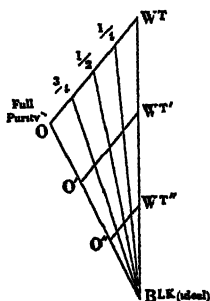


FIG. 55.

ing on the surface. Lines between the line O-Blk and the line Wt -Blk may represent what are relatively $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ Purity.¹

¹ I have never been satisfied that psychologists, and scientists in general, have not frequently used their terms vaguely and inconsistently, or used the same term in two or three different meanings. Thus we are usually told that by the term, Saturation, is meant exactly the same thing which I have here defined by the term, Color Intensity. But in the following passage from *Color and its Application* by Luckiesh, the term Saturation is used as the exact equivalent of what I have designated by the term Purity, and I believe this use of the word is not uncommon:

"On diluting a color with white light, tints are obtained; that is, tints are unsaturated colors. By the admixture of black to a color (in effect the same as reducing the intensity of illumination) the brightness is diminished without altering either the hue or the saturation, and various shades are produced." (p. 71.)

In a similar manner the term "brightness" is, I believe, sometimes used for Value and sometimes for what I have designated by the term Energy of Vibration. The latter is, I believe, the same factor which is usually called by physicists simply "intensity."

It should be noted that the physicist pays ordinarily no attention to the questions of Value and Color Intensity. He is interested only in the strength of the vibration of the light rays and in the spectral composition of different Tones. The chart which he uses is a two-dimensional one which indicates horizontally the rapidity of the vibrations and vertically the strength of the vibrations, as in figs. 27 and 56.

The Orange pigment indicated in figs. 55 and 56 is assumed to reflect the Orange rays of the White light falling on its surface at their full strength. If to this Orange is added a certain amount of the White of the light, its Purity will be lost, or we may say diminished, but the full strength of the vibration of the Orange will remain. More and more of the other rays of White light may be added and the Orange brought nearer and nearer to White, as

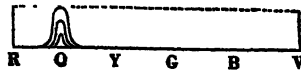


FIG. 56.

in O' and O'' in fig. 57. Even if the Tone is changed entirely to White by adding all the other elements of White light, the Orange will be present in the full strength of its vibration. There is uniform Energy of Vibration, then, on the line O-Wt. What are

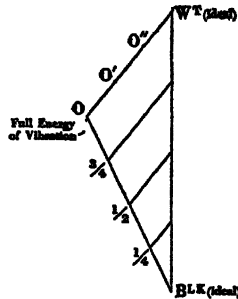


FIG. 57.

relatively $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ Energy of Vibration may be represented by the inclined lines parallel to the line O-Wt.

In other words there is a possibility of uniformity — Harmony — of Purity and of Energy of Vibration, as well as of Value, Color, and Color Intensity. Just how important in design is the question of Purity is at present largely a matter of conjecture. It is supposed that the eye cannot distinguish between a Tone in which the Color is produced by rays of all the same wave length and one composed of Tones made up of a mixture of several wave lengths, and that the visual quality of the Yellow of the spectrum,

for example, may be exactly matched by a stream of light in which there is a mixture of many rays, including some of longer and some of shorter wave lengths than the Yellow rays. So long as there is no diminution of Intensity we might speak of this as pure Yellow nevertheless. This composed Yellow could be reduced down to Black along the line of full Purity of Yellow just as well as the isolated Yellow rays. There is Harmony of relative Purity as objects model from light into shadow. In painting it is ordinarily

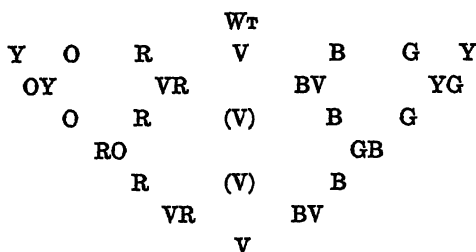


FIG. 58.

very difficult to maintain the relative Purity of a Tone as it approaches Blackness in shadow. The luminosity of some of the Flemish paintings of the XV century, like those by Van Eyck, and the feeling of atmosphere achieved in paintings like those by Ver-

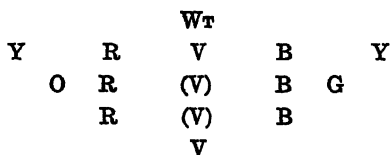


FIG. 59.

meer, is probably due to the use of a procedure which enabled the painters to maintain distinctions of Color at an exceedingly low Value — that is, to maintain the relative Purity of Tones in the darks as in the lights.

In regard to Energy of Vibration, it is noticeable that there is a distinct Harmony of quality in those Tones of a scale, like that shown in fig. 12, which come from the full Intensity of each Color up to White. These are the Tones of the upper surface of the

Tone Solid, and correspond approximately to the Tones of highest Energy which come on the line O-Wt in fig. 57. Monet, Renoir and Dodge Macknight, in their best — at least in their most typical works — use a Tone scheme which is practically entirely confined to this upper surface of the Tone Solid. In other words, there is in their works a Harmony of highest possible Energy, and each Color, being mixed only with White, is maintained, as nearly as is possible in paint, at the strength which it possesses as an element of the total light falling on the surface of the painting. As an hypothesis which seems to work in practice, I should say that this accounted to a large extent for the feeling of harmonious illumination in the works of these painters. As explained in Chapter V and Chapter VI, the transposition into the Monet or Macknight scheme is a perfectly arbitrary artistic device, not in any sense a matter of mere science, as has been frequently maintained. The modelling of objects follows a Sequence of Color from Yellow down to Violet on either the warm or the cool side, which is almost identical with the Sequences of Color employed in VI century Byzantine mosaics and in much mediaeval painting, and is almost as purely conventional.¹

¹ A slight transposition of the double scale shown in fig. 41, with an omission of all the Tones which come below the full Intensity line, and an addition of one or two others, will serve as a scaled palette for painting in this scheme. The palette will then be arranged as in fig. 58 or in fig. 59. The latter makes an especially simple palette. If the scale of fig. 41 is put up in tubes, the extra Reds and Blues can easily be obtained by mixing various Tones on the palette with White. In painting, mixtures must be confined to adjacent Colors. It is unwise, however, for a beginner to attempt to paint in a scale of this sort until he has good control over those in which neutralization is employed, and normal relations of Values and Intensities are expressed.

II

A COMPLETE TONE SOLID

IN Chapters I and II are discussed Tone Solids which have been worked out to show the approximate relations of Tones as they may be achieved in pigment materials. Complete possibilities of Visual Tone, however, cannot be achieved in paint. White pigment, for example, always absorbs a certain amount of the light falling on its surface, and is never more than about 80 per cent perfect. In a similar way Black pigment is never perfect Black. It would be possible, on the other hand, to plot the Tones of the spectrum of White light and all the Tones to be derived from it by mixture, with regard to relations of Color, Value and Intensity. This would be the true Tone Solid which would express the complete possibilities of Tone, and it would be an extremely interesting thing to have. It would be interesting to know, for example, how close the different Tones which can be obtained in pigment materials approach the limits of the true solid. The making of it may be recommended to some one with a knowledge of the technical methods of experimental physics.

III

AFFECTIVE VALUES OF DIFFERENT TONES

PSYCHOLOGISTS have frequently conducted experiments in regard to the affective value of different tones by having persons express their relative preference or dislike for a series of tinted papers. Similar experiments have also been conducted to test variations in emotional reaction to different colored lights. Red is naturally found exciting, and violetish blues on the whole depressing, and so on. Aside from the accidents of association of ideas involved in such preferences and reactions, it must be pointed out that mere agreeableness has very little to do with aesthetic experience. Ordinary likes and dislikes are transcended by the organization that underlies aesthetic reaction of the higher orders. Popular art with its short-lived appeal can hardly afford to be disagreeable, but art with a more lasting value may often be based on motives which in themselves are not at all pleasant. Examples in literature and music will readily occur to anyone. So in tone relations in painting the harmony resulting from definite organization is of much more importance than the superficial agreeableness or pleasantness of this or that tonality except as this is considered in relation to possible surrounding tonalities.

As an aid to expression of emotional reaction, on the other hand, the use of varying tonalities is of considerable importance, especially in connection with stage design. This has long been understood, but for the most part we have been accustomed to rather cheap and crude uses of reddish and yellow and blue tonalities. Much more subtle and complex results should be expected in the experiments that are being conducted on the modern stage. In painting, as well, different tonalities have been used for the sake of their emotional reaction, as, for example, in the case of the golden tonality in much Venetian painting; but there are perhaps possibilities in this direction which have still to be experimented with. Any expression of emotion in this way must necessarily be vague, but it may be none the less effective on that account.

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